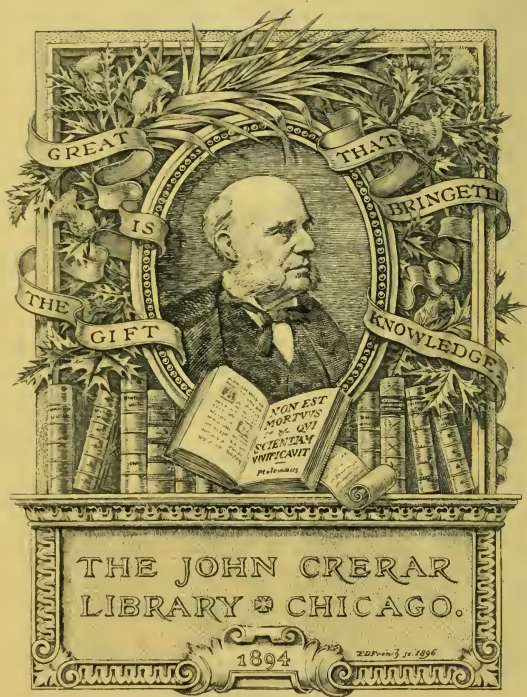
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ANNUAL CATALOG

OF

SOUTH DAKOTA STATE

SCHOOL of MINES

RAPID CITY, SOUTH DAKOTA

NINETEEN HUNDRED ELEVEN
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• 1911 •

JANUARY.

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• 1912 •

JANUARY.

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• 1912 •

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SEPTEMBER

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NOVEMBER.

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DECEMBER.

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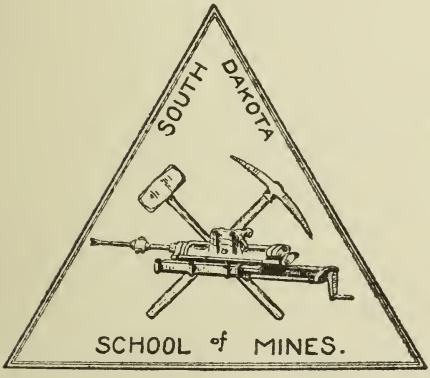
THE SOUTH DAKOTA STATE SCHOOL OF MINES



ANNUAL CATALOG
1911-1912

1911
The Rapid City Daily Journal
Rapid City, S. D.

COLLEGE CALENDAR

School Year begins.....Wednesday, September 20, 1911
Entrance Examinations begin.....September 18, 1911
Registration Committee considers applications for Advanced Standing and Credentials for Admission without examinations.....September 19, 1911
Thanksgiving Day recess.....November 30
to .....December 2, inclusive, 1911
Christmas vacation.....December 21, 1911
to .....January 3, inclusive, 1912
Examination week.....January 29
to .....February 3, inclusive, 1912
First Semester ends.....February 3, 1912
Second Semester begins.....February 5, 1912
Washington's Birthday Anniversary...February 22, 1912
Spring recess.....April 8 to April 15, 1912
Examination week.....May 27 to June 1, inclusive, 1912
Memorial Day.....May 30, 1912
Baccalaureate Sermon.....June 2, 1912
Faculty and President's Reception.....June 4, 1912
Commencement and Conferring of Degrees..June 5, 1912
Second Semester ends.....June 6, 1912

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REGENTS OF EDUCATION.

Members of the Board

THEODORE W. DWIGHT, Sioux Falls.
Term Expires January 1, 1915.

A. E. HITCHCOCK, Mitchell.
Term Expires January 1, 1915.

ALBERT M. ANDERSON, Sturgis.
Term Expires January 1, 1917.

H. REINHARDT, Eureka.
Term Expires January 1, 1913.

HERMAN FREIBURG, Beresford.
Term Expires January 1, 1917.

Officers of the Board

A. E. HITCHCOCK, President, Mitchell.
FRED FORD, Secretary, Elk Point.
GEORGE G. JOHNSON, (State Treasurer),
Treasurer Ex-officio.

Regents Committee in Charge of the School of Mines.

A. M. ANDERSON. A. E. HITCHCOCK.

FACULTY.

CLEOPHAS CISNEY O'HARRA, President, after July 1, 1911.

CLEOPHAS CISNEY O'HARRA, Professor of Mineralogy and Geology.
A. B., Carthage College, Ph. D., Johns Hopkins University.

HOWARD LINCOLN MCLAURY, Professor of Mathematics.
A. B., Oberlin College. A. M., Harvard University.

MARK EHLE, JR., Professor of Mining.
E. M., Colorado School of Mines.

MELVILLE FULLER COOLBAUGH, Professor of Chemistry.
B. S., Colorado College. A. M., Columbia University.

CLAUDE CORNELIUS VAN NUYS, Professor of Physics.
A. B., Yankton College; B. S., E. M., South Dakota State School of Mines; A. M., Columbia University.

JOSEPH HERBERT STEELE, Professor of Engineering.
B. S., Michigan Agricultural College.

JOHN MCLEARIE, Professor of English.
A. B., Macalester College; A. M., University of Chicago.

CLARENCE LESLIE LEWIS, Lecturer on Mining Law.
University of Michigan.

HOWARD MAGILL GERMAN, Instructor in Metallurgy.
B. S., Pennsylvania State College.

REG

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Treasurer Ex-officio.

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A. M. ANDERSON. A. E. HITCHCOCK.

FACULTY.

CHARLES HERMAN FULTON, President and Professor of Metallurgy.
E. M., Columbia University.

CLEOPHAS CISNEY O'HARRA, Professor of Mineralogy and Geology.
A. B., Carthage College, Ph. D., Johns Hopkins University.

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University of Michigan.

HOWARD MAGILL GERMAN, Instructor in Metallurgy.
B. S., Pennsylvania State College.

CHRISTIAN TRYGSTAD, Instructor in Modern Languages and History.
A. B., St. Olaf College; A. M., University of Minnesota.

*HOWARD C. MACOMBER, Instructor in Preparatory Science and Mathematics.
B. S., Union College.

HUGH W. TALBOT, Instructor in Preparatory Science and Mathematics.
B. S., Colgate University.

DELLA MAY HAFT, Librarian.
Ph. B., University of Chicago.

LULU QUIST, Registrar and Secretary to the President.

WILLIAM L. ANDERSON, Assistant in Chemistry.
CHESTER G. EHLE, Assistant in Geology.
CLARENCE G. WILLARD, Assistant in Assaying.
FRANK A. FAHRENWALD, Assistant in Chemistry.

Other Employes.

WILLIAM A. COURSEN, Superintendent of Grounds and Buildings.
MRS. A. O. ANDERSON, Janitor.
FRANK BOYD, Fireman.

*Resigned March 11, 1911.

STANDING COMMITTEES OF THE FACULTY

Committee on Admission and Registration:

Professor Ehle, Chairman.
Professor Van Nuys
Professor Steele
Mr. Trygstad

Committee on Course of Study:

Professor O'Harra, Chairman
Professor McLaury
Professor Van Nuys
Mr. Trygstad

Committee on Theses:

Professor Van Nuys, Chairman
Professor Coolbaugh
Professor Ehle

Committee on Catalog and Publications:

Professor Steele, Chairman
Professor O'Harra
Mr. Talbot

Committee on Emergencies:

Professor Coolbaugh, Chairman
Professor O'Harra
Professor Ehle
Professor McLaury

Committee on Student Welfare:

Professor McLaury, Chairman
Professor Steele
Professor McLearie
Mr. Talbot

Committee on Athletics:

Professor McLearie, Chairman
Professor Ehle
Mr. Trygstad
Mr. Talbot

Committee on Library:

Miss Della M. Haft, Chairman
Professor O'Harra
Professor Coolbaugh
Professor McLearie

Board of Control of the Athletic Association:

Professor Ehle, Chairman
Mr. C. G. Willard, Secretary
Professor McLearie
Professor Fulton
Mr. Frank Fahrenwald
Mr. Cristy Pryer

The regular meeting of the faculty is held on the first Tuesday of each month.

GENERAL STATEMENT.

Establishment of the School.

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of land, lying in the State of South Dakota, and a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate, and have control of the various public institutions of learning maintained wholly, or in part, by the State as State Institutions.

The following is an extract from the act of the legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States, and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School.

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the State will be aided. Whenever it is possible, the School also aids the development of the mineral resources by the investigation of mining and metallurgical problems which arise in the state. At the present time, many graduates of the School are employed in responsible positions in the Black Hills and throughout the

West generally, and are doing much toward the development of the State's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills was due in a large measure to the experiments performed at the State School of Mines. This refers particularly to the chlorination process and to sulphide smelting. The School issues, from time to time, bulletins treating of Black Hills economic geology, and of mining and metallurgical methods, which can be obtained by those interested, upon request.

The first building of the School was erected in 1885, and is a three-story brick structure in which were originally, chemical and assay laboratories, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The School, however, under able management, steadily, though slowly, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building is 138 by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901 what is now the Main Building of the School was erected, the legislature appropriating $20,000 for that purpose. In 1903 another $20,000 was appropriated by the legislature for an addition to the Main Building, and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant, etc., in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for extension of heating plant and improvements to the metallurgical laboratory.

The number of buildings and equipment, at the present time, is such as to give good facilities for thorough instruction in mining and metallurgy, and allied subjects.

LOCATION.

The School of Mines is located in Rapid City, in the foothills of the Black Hills of South Dakota. It is on the Chicago & Northwestern Railway, on that branch extending from Omaha to Deadwood and Lead, South Dakota. Rapid City has direct connection with the eastern part of the state, by means of a branch of the same railroad from Pierre; and also by the Chicago, Milwaukee & St. Paul Railway from Chamberlain, South Dakota. It has also connection with the Burlington system by means of the Rapid City, Black Hills & Western Railway from Rapid City to Mystic.

Rapid City is a growing city of about 4,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid Creek, and a half hour's walk takes one either out on the plains or into the hills. It has large stores of all kinds, and living is comparatively cheap for a western town. It offers many advantages as a college and residence city. It has seven churches, representing practically all the principal denominations. There are costly water works fed by springs, four miles back in the hills; also a modern illuminating gas works and an electric lighting plant furnishing the city with light, and a modern sewer system.

The elevation of the city is 3,200 feet above sea level and the climate is a very healthful one, the winters being usually mild and the summers cool. The climate is dry, the average rainfall being about 20 inches.

There is much social life in the town, and students, after becoming acquainted, may enjoy the influences of home life. The students of the School find board and lodging in the homes, as the School does not maintain a dormitory.

The distance to Deadwood is only 46 miles and but a little more into the heart of the great producing mining section of the Hills. The mining districts of Keystone, etc., are within 25 miles of Rapid City. It was thought desirable to locate the School at some distance from the active mining region, rather than directly within it, for it is now realized in technical education that the teaching of the fundamental sciences must be thoroughly accomplished before their technical application can be considered. If the School were located directly within the bustle of the mines and mills, it is very probable that, to some extent, the extremely practical surroundings might interfere with proper methods of study of the preliminaries.

In the last two years of the course, many visits are made to the active mining districts for the purpose of a close study of the methods in vogue. Besides the summer school work in mining and surveying, described elsewhere, many students find work during the summer in the mines of the Black Hills.

The location of the School is very favorable for the study of Geology. The Black Hills have long been known to afford remarkable facilities for the field study of Geology, in that the rocks of practically all ages are exposed in the uplift of the Black Hills. The great eruptive district of the northern Hills affords fine opportunities for this branch of Geologic study.

BUILDINGS AND EQUIPMENT

Buildings and Grounds

The buildings in which the work of the School is carried on are three in number: First, the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which students, found deficient in studies for entrance into the School of Mines, are properly prepared. It contains a large assembly room and class rooms for the study of languages, mathematics, history, and a laboratory for biology. It is heated throughout by steam, furnished from the central power plant, and is lighted by electricity.

In the center of the grounds is the main building of the School, a large brick structure, with native sandstone trimmings, three stories in height, built in two wings in the shape of a T. This building contains in the front wing, on the first floor, a large entrance hall, a Geological Museum, class rooms in Mathematics and English, the President's and the Registrar's offices. On the second floor are chemical laboratories, comprising the general, qualitative and quantitative laboratories, and offices and class rooms of the Department of Chemistry. The basement of the building contains the physical laboratory and store rooms. The first floor of the rear wing of the main building contains the Library and the remainder of the Department of Geology and Mineralogy, consisting of class rooms and offices, and a thoroughly equipped mineralogical laboratory. The second floor contains the Department of Engineering, consisting of instructor's offices, two large drawing rooms for the Freshmen and Sophomore classes respectively, a large lecture room, and a thoroughly equipped room

for making blue prints. In the basement of this wing is a well equipped machine shop with store rooms. The machine shop serves the purpose of enabling the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories in height, built of red brick with stone trimmings. This building is devoted exclusively to the Departments of Mining and Metallurgy. It contains, on the first floor, a large chemical laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus.

On the second floor are located the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and a Mining and Metallurgical Museum.

On the east part of the school grounds is located the central heating plant, containing boilers, etc., which supply heat for the three large buildings mentioned above, and power for the metallurgical laboratory. It is built of stone and has adjoining sheds with a large capacity for the storage of coal.

Equipment.

In general, the School is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

LIBRARY.

The library of the South Dakota State School of Mines consists of standard works in Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, English, History, Economics, and many works of a general nature.

The library and reading room occupy a large, well lighted and well equipped room on the first floor of the annex to the Main Building.

In this room is also placed a library of 400 volumes of a miscellaneous nature which the Rapid City Library Association loans the School.

On the reading tables are found the best journals on Mining, Metallurgy, Geology, Chemistry and Engineering, as well as magazines of more general interest.

The following journals are on file:

Mining and Scientific Press.
Engineering and Mining Journal.
Mines and Minerals.
Mining Magazine, London.
Mining Science.
The Analyst.
Columbia School of Mines Quarterly.
Bulletins, American Institute of Mining Engineers.
Bulletins, Institution of Mining and Metallurgy.
Journal, Chemical, Metallurgical and Mining Society of South Africa.
Journal of Society of Chemical Industry.
Industrial and Engineering Chemistry.
Metallurgie.
Chemical Engineer.
Economic Geology.
Bulletins, Geological Society of America.
Journal of Geology.
Geologisches Zentralblatt.
Engineering News.

Engineering Magazine.
Proceedings of the American Institute of Electrical Engineers.
American Journal of Science.
Journal, American Chemical Society.
American Chemical Journal.
Journal of the Society of Chemical Industry.
Electro-Chemical and Metallurgical Industry.
Mining World.
National Geographic Magazine.
Zeitschrift der Anorganischen Chemie.

The reference works contain, among others, complete or partial sets of bound volumes of the following publications:

Transactions American Institute of Mining Engineers.
Transactions Institution of Mining and Metallurgy.
Engineering and Mining Journal.
Mining Reporter.
Bulletins, Geological Society of America.
Journal, Chemical, Metallurgical and Mining Society of South Africa.
Journal of Geology.
American Geologist.
The Mineral Industry.
Bulletins of U. S. G. Survey, and others.
American Journal of Science.
Proceedings of the Royal Society of London.
Journal of the Iron and Steel Institute.

Each department of the library is represented by works of the leading authorities in that branch of science.

The card system of cataloging is in use and current technical journals are catalogued month by month.

Drawing Rooms.

In the Department of Engineering are two large drawing rooms—one for Freshmen and Sophomore work, the other for Junior work.

The rooms are fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. The drawing rooms are well lighted by many windows. Adjoining the Freshmen drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. A large sink for the washing of prints is provided.

Chemical Laboratories.

There are three chemical laboratories—one for general chemistry, one for qualitative analysis, and one for quantitative analysis. The last two laboratories are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate balance room in which are analytic balances of standard makes, among them Becker's and Troemner's.

The apparatus is ample for all mineral, alloy and rock analysis, and includes combustion furnaces, apparatus for gas analysis, facilities for electrolytic precipitations, calorimeters for fuel analysis and spectroscopes for qualitative experiments.

Physical Laboratory

The Physical Laboratory is located in the basement of the annex to the Main Building, thus securing absolutely stable foundations for such apparatus and instruments as require it.

The laboratory is thoroughly equipped with physical apparatus, such as balances, Atwood ma-

chine, air pumps, hydrometers, specific gravity apparatus, spectroscopes, spectrometers, apparatus for measurements in light and sound, calorimeters, electrical apparatus, such as Wheatstone bridges, magnetometers, voltmeters, ammeters, wattmeters, galvanometers, electro-dynamometers, potentiometers, electrometers, fluxmeters, wireless telegraphy and telephone, engine indicators, etc. For electrical experimentation, dynamos and motors are available.

Assay Laboratory.

The Assay Laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances, for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains five double muffle-furnaces, heated by soft coal.

These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt where it is very undesirable. The furnace room is fire-proof. There is a melting furnace using coke, and gasoline furnaces made by Braun & Company, San Francisco.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for the making of cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The near-

ness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire samples for close checking work.

Metallurgical Laboratory.

This laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead, and is best adapted to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filteration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ in. centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The smelting machinery consists of a 130 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrat-

ing machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc. The metallographic laboratory is equipped with six metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus of various kinds, including potentiometer, resistance boxes, etc.

Other scientific metallurgical apparatus such as calorimeters, pyrometers, apparatus for gas analysis, is available for frequent use. A special chemical laboratory is provided in the metallurgical building for metallurgic analysis in connection with cyanidation and smelting.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus by the department, upon the payment of a small fee. Each student has his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum.

The museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a store house of curiosities. The room is thirty-six by forty-seven feet in size and lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are

eight central cases, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such manner as to serve practically as two sections, fitting tightly, back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition. The cases are of oak.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double-door compartments of six shelves. The cases are practically adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White River Badlands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis Exposition.

The museum has also recently been enriched by the gift of a very valuable and unique rock section of the

Homestake Mine, donated by the Homestake Mining Company of Lead, South Dakota.

The collection of minerals exhibited by the School at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, etc., wall boards of hoisting ropes and screens, and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The School is always very grateful for donations of this kind and makes due acknowledgment for the same.

Shops.

In the basement of the Main Building a large workshop is provided, containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for the design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the School considerable sums of money. The students of the upper classes are granted permission to use the facilities offered by the shop, whenever occasion arises to do so in their work.

PUBLICATIONS.

Bulletin No. 1.—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888 (Out of print.)

By F. R. Carpenter and H. O. Hofman.

Bulletin No. 2.—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages. Department of Geology. 1899.

By C. C. O'Harra and A. Forsyth.

Bulletin No. 3.—Cyanide Experiments on the Silicious Ores of the Northern Black Hills, etc.; 27 pages. Department of Metallurgy. 1900.

By A. Forsyth and G. H. Clevenger.

Bulletin No. 4.—History of the Early Explorations, etc., in the Black Hills, and Bibliography of Contributions to the Geology of the Black Hills Region; 88 pages. Department of Geology. 1900. (Out of print.)

By C. C. O'Harra.

Bulletin No. 5.—The Cyanide Process in the Black Hills of South Dakota; 88 pages. Department of Metallurgy. 1902.

By C. H. Fulton.

Bulletin No. 6.—The Mineral Wealth of the Black Hills; 88 pages. Department of Geology. 1902. (Out of print.)

By C. C. O'Harra.

Bulletin No. 7.—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. Department of Metallurgy. 1904.

By C. H. Fulton.

Bulletin No. 8.—The Cement Resources of the Black Hills; 55 pages. 1908. By M. F. Coolbaugh, C. C. O'Harra, C. H. Fulton and M. Ehle.

Bulletin No. 9.—The Badland Formations of the Black Hills Region; 152 pages. Department of Geology. 1910. By C. C. O'Harra.

Annual Catalog; Descriptive of the Courses given by the School, and Containing General Information.

Announcements containing information about the School issued regularly.

The publications of the School may be had, free of charge, by addressing the President.

STUDENTS' EXPENSES.

Tuition.

The tuition and incidental fee is $6 per semester, or $12 per year, payable in advance on registration. This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tutition, two students, appointed by each State Senator, and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said Senator or Representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees.

Fees enumerated below cover the bare cost of materials and supplies consumed in the laboratories and loss due to breakage, etc.

All fees are payable at the beginning of each semester, on registration. (Consult Departments of Instruction for description of courses.)

Chemistry 1-2, Elementary Chemistry, per semester	$ 4.00
Chemistry 11-12, Qualitative Analysis, per semester	7.00
Chemistry 17-18, Quantitative Analysis, per semester	8.00
Chemistry 21-22, Metallurgical Analysis, per semester	8.00
Metallurgy 24, Assaying, per semester	25.00
Metallurgy 19-21-22, Metallurgical Laboratory, per semester	5.00
Metallurgy 11, Metallography	5.00
Mineralogy 1, General Mineralogy, per semester	5.00
Mineralogy 2, Blow-pipe Analysis, per semester	5.00
Geology 3-4, Petrography, per semester	2.00
Physics 3-4, Elementary Physics, per semester	1.00
Physics 7-8, Advanced Physics, per semester	2.00
Engineering 1-2, Mechanical Drawing, per year	1.00
Engineering 3-4, Mechanical Drawing, per year	1.00
Engineering 5-6, Surveying, per semester	3.00
Engineering 9, Machine Design	1.00
Preparatory Science, per semester	2.00
Chemistry, all courses, deposits to cover breakage, etc.	5.00
Metallurgy, all courses, deposits to cover breakage	5.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Athletic Association Fee, per year	5.00
Fee for permit for "conditioned" examination	2.00

(Note.—No platinum is furnished by the Department of Chemistry.)

Other Expenses of the Nature of Fees.

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately, $7.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Mechanical Drawing, will cost approximately $4.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $3.00 for the year.

LIVING EXPENSES.

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varing from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $4 upwards, per week. This makes the expense for board and room for the school year of 37 weeks range from $185 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expense is about $20 for the school year.

Cost of Text Books.

Freshmen year	$13.00
Sophomore year	17.00
Junior year	23.00
Senior year	19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshmen year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added according to individual taste.

Incidental Expenses.

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshmen year usually costs the student about $10. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help.

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn funds.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The School is able to assist Junior and Senior students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a resi-

dence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the School should be provided with sufficient funds to carry him through the first year, at the very least.

STUDENTS' ORGANIZATIONS AND ATHLETICS

The student organizations are the Students' Association and the Athletic Association. The Students' Association has for its aim the general welfare of the student body. The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basketball teams, and track athletics. Membership in this association is obligatory, all students paying the annual fee of $5.00. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior, and Senior classes respectively, and one Alumni member. The association maintains baseball, football, and tennis grounds. The School heartily encourages athletics within the proper limits.

The Triangle Club is a students' literary association.

Y. M. C. A.

There is a flourishing Y. M. C. A. in the city, of which many of the faculty and students of the School are members. This organization maintains a very complete reading room and well equipped baths for the use of the members. There is also a gymnasium which supplements the athletics of the School of Mines.

CONDUCT.

The School has no codified rules of conduct. Students are held to a strict account of their work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the School.

DETERMINATION OF MINERALS AND ASSAYING.

Minerals are determined free of charge. Samples for determination should be addressed to the Department of Geology, State School of Mines, Rapid City. Assays for gold and silver, etc., and chemical analyses both quantitative and qualitative, are made at reasonable rates. Prices will be sent upon application to the Department of Metallurgy. All samples for analysis or assay should be addressed to this department.

REQUIREMENTS FOR ADMISSION.

Freshman Class.

Requirements for admission to the Freshman class are as follows:

Fourteen units are necessary for entrance.

Required Units.

Arithmetic	1.	unit
Algebra	1.5	units
Plane Geometry	1	unit
Solid Geometry	0.5	unit
English	2	units
History	1	unit
Physics	1	unit
Chemistry	1	unit
Total required units	9	

Elective Units.

German	1, 2 or 3 units
French	1, 2 or 3 units
Latin	2, 3 or 4 units
Greek	1 unit
Spanish	1 or 2 units
English	1 or 2 units
History	1 or 2 units
Mathematics	0.5 unit
Science	1 or 2 units
Drawing	1 unit
Shop Work	1 unit
Civil Government	0.5 unit
Bookkeeping	1 unit
Elective units required for entrance	5

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School.

First: By Certificate. Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Second: By examination. All other candidates for admission to the regular engineering courses will be required to pass entrance examinations in the subjects specified. These examinations are held at Rapid City on dates mentioned in the calendar. Students who are deficient in subjects required for entrance into the regular engineering courses are permitted to enter the Preparatory Department, maintained by the School for the special purpose of preparing students so deficient.

Credentials for entrance should be in the hands of

the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE.

Required Units.

Mathematics.—The four and one-half units which may be offered in mathematics are as follows:

Arithmetic—One unit, complete, including the metric system.

Algebra—One and one-half units. The equivalent of A, B and C algebra described under Preparatory Mathematics in the Preparatory Catalog.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Two units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Catalog.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Catalog.

History—One unit. The History of the United States, English or Ancient History, as described under History, in the Preparatory Catalog.

Elective Units.

The equivalent of courses, not mentioned above, described under Mathematics (trigonometry only). Languages, History, English and Preparatory Science, in the Preparatory Catalog.

Special Students.

Applicants for admission, who are graduates of college or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses, particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the School to take advanced courses, such as Assaying, Metallurgy, etc.

Admission to Advanced Standing.

Graduates of college and technical schools who enter the School as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decides these cases upon the basis of individual merit.

Degrees.

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two

years' successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Students who complete the studies in the Preparatory Department will receive, therefor, the usual diploma.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree. This thesis will be assigned to the individual members of the Senior class by a special thesis committee of the faculty. The standard form of thesis shall be the working out of plans for the development of an hypothetical mine, such subject to be assigned to all students except that the thesis committee may vary the subject as its judgment dicates. Report of progress in thesis work must be made at stated intervals to the thesis committee. Theses must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the Library. No degree will be granted unless the conditions concerning theses are fully satisfied.

Summer School.

The summer school begins immediately after commencement. Three weeks are devoted by the Junior class to surveying in the field and underground, and one week by the Senior class to visits to mines and metallurgical works.

COURSES AND DEPARTMENTS.

The courses given by the School of Mines are:
First—Mining Engineering Course.....4 years
Second—Metallurgical Engineering Course..4 years

SYNOPSIS OF COURSES.

Mining Engineering Course.

FIRST YEAR

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9, 11—Qualitative analysis	32	144
Geology 1—General geology	64	48
Engineering 1—Mechanical drawing		96
English 9—Composition	64	
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	80	
Chemistry 6, 8—General chemistry	48	48
Chemistry 10, 12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing		96
English 10—Composition	64	
	272	288
Hours per week	17	18

SECOND YEAR

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry	32	
Chemistry 15, 17—Quantitative analysis	32	144

Mineralogy 1—General mineralogy	48	48
Engineering 3—Descriptive geometry		96
Engineering 5—Surveying	48	48
	240	336
Hours per week	15	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow pipe analysis	16	96
Engineering 4—Descriptive geometry		48
Engineering 6—Surveying	24	48
Metallurgy 2—General metallurgy	48	
Mining 2, 4—Mine surveying	24	Summer
	256	336
Hours per week	16	21

THIRD YEAR

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	48	
Geology 3—Physical geology	48	48
Engineering 7—Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	280	288
Hours per week	17½	18

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Engineering 14—Mechanics of materials	64	

Geology 4—Petrography	48	48
Economics	48	
Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking	48	
	320	336
Hours per week	20	21

FOURTH YEAR

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Geology 5—Economic geology	64	
Mining 7—Drainage, transportation	32	
Mining 9—Shaft sinking, exploitation	48	
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Iron and steel	32	
Mining 11—Mine design		96
Mining 13—Mine accounting		32
Metallurgy 19—Laboratory		48
Thesis		48
	288	272
Hours per week	18	17

Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics	32	
Engineering 18—Hydraulics	32	24
Geology 6—Economic geology	64	
Mining 8—Mine administration	32	
Mining 10—Ventilation and lighting, placer mining, mine examination	48	
Metallurgy 8—Copper and lead	32	
Engineering 20—Power plants	32	24
Mining 12—Mine designing		96
Mining 14—Mining law	16	
Metallurgy 20—Mill run		48

Thesis		96
	288	288
Hours per week	18	18

Metallurgical Engineering Course.

FIRST YEAR

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9, 11—Qualitative analysis	32	144
Geology 1—General geology	64	48
Engineering 1—Mechanical drawing		96
English 9—Composition	64	
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	80	
Chemistry 6, 8—General chemistry	48	48
Chemistry 10, 12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing		96
English 10—Composition	64	
	272	288
Hours per week	17	18

SECOND YEAR

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry	32	
Chemistry 15, 17—Quantitative analysis	32	144
Mineralogy 1—General mineralogy	48	48
Engineering 3—Descriptive geometry		96

Engineering 5—Surveying	48	48
	240	336
Hours per week	15	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemical 14—Industrial chemistry	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow pipe analysis	16	96
Engineering 4—Descriptive geometry		48
Engineering 6—Surveying	24	48
Mining 2, 4—Mine surveying	24	Summer
Metallurgy 4—General metallurgy	80	
	288	336
Hours per week	18	21

THIRD YEAR

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	48	
Chemistry 19, 21—Quantitative analysis	48	96
Engineering 7—Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	280	336
Hours per week	17½	21

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Engineering 14—Mechanics of materials	64	
Chemistry 20, 22—Quantitative analysis	16	32
Economics	48	

Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking	48	
	288	320
Hours per week	18	20

FOURTH YEAR

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Iron and steel	32	
Metallurgy 11—Metallography	16	48
Metallurgy 13—Electrometallurgy	32	
Metallurgy 15—Zinc and minor metals	32	
Metallurgy 17—Metallurgical design		96
Metallurgy 21—Metallurgical laboratory		96
Mining 13—Mine accounting		32
Mining 7—Drainage, transportation	32	
Thesis		48
	256	368
Hours per week	16	23

Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics	32	
Engineering 18—Hydraulics	32	24
Engineering 20—Power plants	32	24
Metallurgy 6—Gold and silver	48	
Metallurgy 10—Copper and lead	80	
Mining 14—Mining law	16	
Metallurgy 18—Metallurgical design		48
Metallurgy 20—Mill run		48
Metallurgy 22—Metallurgical laboratory		96
Mining 8—Mine administration	32	
Thesis		96
	272	336
Hours per week	17	21

DEPARTMENTS OF INSTRUCTION.

Department of Metallurgy.

PROFESSOR FULTON MR. GERMAN

MR. WILLARD

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated, in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, as it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, miscroscopes for the examination of metals and furnace products, and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with the actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 2. MR. GERMAN.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussion of metallurgical principles; slags and furnace products, and their nature; types of furnaces and furnace construction ;the means of supplying and heating blast; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes, and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room, and hand in for examination, papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior year, and is described under Metallurgy 19.

Sophomore Year, Mining Engineering option, Second Semester: Three lecture hours per week.

Text Book: Fulton, Principles of Metallurgy.

Metallurgy 4. MR. GERMAN.

Introductory Metallurgy. Same course as Metallurgy 2, but amplified by detail.

Sophomore Year, Metallurgical option, Second Semester: Five hours per week.

Text Book: Fulton, Principles of Metallurgy.

Metallurgy 5. PROFESSOR FULTON.

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up, first, modern stamp mill practice; discussing in detail, mortar boxes, stamps, screens, general

battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is taken up in detail; the general mill arrangements; clean up; the influence of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is taken up. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation and the proper performance of laboratory experiments is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior Year, both options, First Semester: Three hours per week.

Text Book: Austin, Metallurgy of the Common Metals. Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Milling; T. K. Rose, Metallurgy of Gold.

Metallurgy 6. PROFESSOR FULTON.

The Metallurgy of Gold and Silver: This course comprises lectures on the cyanidation of silver ores; the melting and refining of gold and silver bullion; the parting of gold from silver; detailed discussion of the roasting of gold and silver ores, preliminary to extraction processes; the chlorination process; details of gold milling processes not taken up in course 5.

Senior Year, Metallurgical option, Second Semester: Three hours per week.

Text Book: Julian & Smart, Cyaniding of Gold and Silver Ores.

Metallurgy 7. MR. GERMAN.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, First Semester: Two hours per week.

Text Book: H. H. Campbell, The Manufacture and Properties of Iron and Steel.

Metallurgy 8. MR. GERMAN.

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up; also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining option, Second Semester: Two hours per week.

Text Book: Austin, Metallurgy of the Common Metals. Reference works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting; Iles, Lead Smelting; Schnables, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 10. PROFESSOR FULTON.

The Metallurgy of Copper and Lead: The same as Metallurgy 8, except that it is amplified by detail.

Senior Year, Metallurgical option, Second Semester: Five hours per week.

Metallurgy 11. PROFESSOR FULTON.

Metallography: The study of metals and alloys by the microscope. The preparation of microsections. Thermal analysis. The study of iron, steel, brasses, bronzes, bearing metals, etc. Micro-photography.

Senior Year, Metallurgical option, First Semester: One hour per week lectures, three hours per week laboratory work.

Text Book: Goerens, Metallograpy.

Metallurgy 13. PROFESSOR FULTON.

Electro-metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, silver, lead nickel and tin.

Electrothermic processes. Theory, The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc and for miscellaneous purposes.

Senior Year, Metallurgical option, First Semester: Two hours per week.

No text book required. Reference works: Stans field, The Electric Furnace; Borchers, Electric Smelting and Refining.

Metallurgy 15. MR. GERMAN.

The Metallurgy of Zinc, and the Minor Metals: The roasting of zinc ores; zinc distillation furnaces; the distillation process, the purification of spelter; commercial considerations. The metallurgy of nickel antimony, tin, bismuth, tungsten and arsenic.

Senior Year, Metallurgical option, First Semester: Two hours per week.

No text book required. Reference work: Ingalls, The Metallurgy of Zinc and Cadmium.

Metallurgy 17-18. PROF. FULTON, MR. GERMAN.

Metallurgical Design: The design of furnaces, flues, chimneys, dust chambers, etc.; mill apparatus, such as classifying cones, elevators, tanks, amalgamating tables, etc.; the design of mill and smelting buildings.

Senior Year, Metallurgical option: Six laboratory hours per week for the first semester and three laboratory hours per week for the second semester.

Metallurgy 19. MR. GERMAN.

Metallurgical Laboratory: Laboratory practice in pyrometry; the calibration of the thermo couple; the roasting of ores, noting the formation of sulphates, etc.; the desilverization of lead bullion by means of zinc; the electrolytic deposition of copper and lead; the roasting of gold and silver ores; experiments with the cyanide process, including the titration of pure and mill solutions with silver nitrate, analysis of cyanide solutions, cyanide experiments with small lots of ore in the laboratory to determine extraction, etc.

Senior Year, Mining Engineering option, First Semester: Three laboratory hours per week.

Text Book: Clennell, Chemistry of Cyanide Solutions, and Howe. Laboratory Note Book.

Metallurgy 20. PROF. FULTON, MR. GERMAN.

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, both options, Second Semester: Forty-eight hours.

Metallurgy 21-22. PROF. FULTON, MR. GERMAN.

Metallurgical Laboratory: Course similar to Metallurgy 19, but amplified.

Senior Year, Metallurgical option: Six laboratory hours per week throughout the year.

Metallurgy 24. MR. GERMAN.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are pre-requisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents; the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and the excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloys for platinum, iridium, etc.; the assaying of lead, tin, bismuth, and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, both options, Second Semester: Two lecture periods and nine laboratory hours per week.
Text Book: Fulton, Manual of Fire Assaying.

Department of Geology and Mineralogy.

PROFESSOR O'HARRA MR. EHLE

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, andesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to near-by points of interest and occasional-

ly a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2.

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical, and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and

history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year: Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Chamberlain and Salisbury's College Geology.

Mineralogy 1.

General Mineralogy: This course is planned to develop such information as may be needed for quick and accurate determination of mineral species in the field. The course is based on lectures, text book and laboratory work and embraces frequent rigid quizzes on features of chief importance. The physical properties of minerals are dealt with in the early part of the course; a brief study of Crystallography introducing this part of the subject. This is followed by a careful physical study of the chief economic and rock-making minerals in systematic order. Good collections, containing most of the common species of mineral and many of the rare ones, are arranged for convenient use in the laboratory and museum. Thoroughly accurate observation of labeled specimens from many localities is insisted upon, and every attention is given to simple, practical methods in the determination of unknown materials.

Sophomore Year, First Semester: Three lecture periods and three laboratory hours each week.

Text Book: Moses and Parson's Mineralogy, Crystallography, and Blowpipe Analysis.

Mineralogy 2.

Blowpipe Analysis: This course is closely associated with Course 1 and continues the same object in view, i. e., the teaching of quick methods of mineral determination. It is chiefly a laboratory study, oc-

cupying one lecture period and six laboratory hours throughout the second semester of the Sophomore year. Approximately the first third of the semester is devoted to the study of blowpipe methods, known minerals being chiefly used. After this, the student is given only unlabeled specimens, the nature and name of which he is required to learn, keeping for reference a detailed record of all results obtained during the process of determination. It is expected that, upon completing this and the preceding course, the student will have gained a fair working knowledge of approximately two hundred of the common minerals, including the chief features of their distribution, uses, value and output.

Sophomore Year, Second Semester: One lecture period and six laboratory hours per week.

Text Book: Brush - Penfield's Determinative Mineralogy and Blowpipe Analysis.

Geology 3.

Physical Geology, including Metamorphism: The purpose in this course is to bring out in some detail certain important features, too briefly considered in General Geology, that have close connection with the subjects of Petrography and Economic Geology which follow. Processes of disintegration, denudation, and deposition, crustal disturbance, and metamorphic influences, receive attention, particularly with reference to their immediate or ultimate relation to ore formation. The physical action of underground water commands careful study, and where physical phenomena are closely connected with chemical activity, the chemical processes in the influencing of mineral reorganization receive proper consideration. In this, as well as in all other courses described, features of economic importance will receive particular attention, but it should be understood by the student, that the full aim of the course is to afford opportunity for as

thorough and comprehensive a grasp of the subjects in hand as the time devoted to them will allow.

Junior Year, First Semester, Mining Engineering option: Three lecture periods and three laboratory hours per week.

Text Book: Lecture notes.

Geology 4.

Petrography: This course is intended especially for mining students who need some training in rock determination, but who have opportunity to devote only a brief time to the subject. It embraces the macroscopic and microscopic study of specimens and is conducted by means of lectures, text books, and laboratory work. The lectures are devoted to the discussion of petrographical methods, the nomenclature of rock species, the principles of rock classification and the origin, distribution, modes of occurrence, alterations and relations of rock masses. The laboratory work embraces the study of hand specimens of rocks, the making of thin rock sections and the examination of such sections by means of the petrographical microscope. Little more than a short summary is given of the refined methods of microscopic analysis, most of the time being devoted to the simpler field methods of determining and classifying the commoner rock types. Two good Zeiss petrographical microscopes, together with necessary accessories, are avilable for use. There is also a Krantz collection of 350 rock types in hand specimens and in thin sections, and a fairly complete series of Black Hills rocks, a number of which have been thin sectioned for study.

Junior Year, Second Semester, Mining Engineering option: Three lecture periods and three laboratory hours per week.

Text Book: Kemp's Handbook of Rocks.

Geology 5-6.

Economic Geology: This course runs throughout

the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used . Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology of the United States; Kemp's Ore Deposits of the United States and Canada.

Department of Mining.

PROFESSOR EHLE.

The instruction in mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to near-by mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mining region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the School, which has proven a most valuable adjunct to the work of instruction, has been completly overhauled and re-equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore will here be carried out by students on a scale approaching commercial practice.

A summer school of mining is held each year immediately following the close of school in June. A suitable mining locality having been selected, students, under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Junior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a whole-

some regard for the efforts of the department and constitutes one of its most valued assets.

The following courses are offered by the department:

Mining 1-3.

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Four lecture periods and three laboratory hours per week.

Mining 2-4.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year, Second Semester: Three lecture periods per week for eight weeks.

The field work of this course occupies one week of the summer school in June, between the Sophomore and Junior years, and with the subsequent calculation and plotting of notes here obtained, completes the course.

Mining 5.

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters; steam shovel; dredges, etc; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; costs of blasting operations.

Junior Year, First Semester: Three lecture periods per week.

Mining 6.

Tunneling: The driving of mine tunnels and drifts through rock and through soft or running ground; comparative costs; general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft Sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water bearing strata, by approved methods; costs of same.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Junior Year, Second Semester: Three lecture periods per week.

Mining 7.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive powers; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tramways and aerial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 8.

Compressed Air and Its Uses. The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Senior Year, Second Semester: Two lecture periods per week.

Mining 9.

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and

chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames; pneumatic hoisting; costs.

Senior Year, First Semester: Three lecture periods per week. Mining Engineering Option.

Mining 10.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer Mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging; costs and results.

Mine Examination: Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties; forms of report.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 11-12.

Design of Mine Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 13.

Mine Accounting: Organization of corporations

and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc.; accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods of business; buying and selling ores; labor, etc; organization of the staff of a mining and metallurgical company.

Senior Year, Second Semester: One lecture period per week.

Mining 14. MR. C. L. LEWIS.

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing, among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate; the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, First Semester: One lecture period per week for fifteen weeks.

Department of Engineering.

PROFESSOR STEELE.

The aim of this department is to give the student such training in the class room, drawing room and field as will properly fit him for his career as a mining engineer.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size; lecture room and offices. The rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Engineering 1-2.

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, and both free hand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:

One pair of 6-in. Compasses, with pen, pencil and needle points.

One pair 6-in. Dividers.
One 5½-in. Ruling Pen.
One 3½-in. Steel Spring Bow Divider.
One 3½-in. Steel Spring Bow Pencil.
One 3½-in. Steel Spring Bow Pen.
One T Square with 30-in. blade.
One 4½-in. Protractor.
Two Irregular Curves.
One 7-in. 30 deg. by 60 deg. Triangle.
One 8-in. 45 deg. Triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

Anthony's Mechanical Drawing is used as a text book.

Drawing boards and key for locker are furnished by the School on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Engineering 3-4.

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six laboratory hours per week; Second Semester: Three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Engineering 5-6.

Surveying: It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. For this reason, the discussions in the class room are confined to such principles as can be given a practical application in the field or drawing room.

The institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just a sufficient number in each to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make

his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; geodetic surveying, including the measurement of a base line; measurement of the horizontal angles; computations for the adjustment of the triangulation system; determination of the meridian by means of the solar instrument; determination of latitude; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying will receive as much time as the conditions will permit. Trigonometry is a prequisite.

Sophomore Year, First Semester: Three lecture periods and three hours field work per week; second semester, three lecture periods per week for eight weeks and three hours field work per week for the whole semester.

A three weeks' summer school for practical work immediately follows the close of school in June, and completes the course in surveying. Two weeks are devoted to general surveying and one week to mining surveying under the Department of Mining.

Text Book: Johnson's The Theory and Practice of Surveying.

Engineering 7.

Topographic Drawing: This work consists in the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Engineering 5-6.

Junior Year: Three laboratory hours per week for eight weeks.

Engineering 9.

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminent practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. The application to mining machinery is always kept in mind. Drafting room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week.

Engineering 11-12.

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amount of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: One lecture period and three laboratory hours for eight weeks of the first semester and all of the second semester.

Text Book: Hoskins, Elements of Graphic Statics.

Engineering 14.

Strength of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast-iron, wrought iron, steel, and timber; pipes and riveted

joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Engineering 15. PROFESSOR VAN NUYS.

Electrical Engineering: This course deals with the principles and general construction of dynamo-electric machinery; systems of direct current distribution; direct current motors, their action, control and application; lighting equipments; the design; installation and operation of electric power plants, the principles and general construction of alternating and polyphase dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments, in the operation and testing of direct and alternating current generators, motors, and transformers, in electrical measurements, and photometry of electric lamps.

Senior Year, First Semester: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Franklin & Esty, Elements of Electrical Engineering, 2 Vols.

Engineering 16. PROFESSOR VAN NUYS.

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Senior Year. Second Semester: Four lecture periods per week for eight weeks.

Engineering 18. PROFESSOR VAN NUYS.

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 5, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water. He learns the methods of commercial measurement of water by both weir and orifices. The problems include the computation of diameters of pipes; pressure and energy of confined water; dimensions of channels and ditches; velocity of flow, etc.

The School is favorably situated for field work in hydraulics. Rapid Creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for weir and velocity measurements; two large irrigation ditches are adjacent to the School, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Four lecture periods and three laboratory hours per week for eight weeks.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Engineering 20. PROFESSOR STEELE.

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels.

The School has three 40-horse-power boilers and a 40-horse-power Corliss engine; also a gasoline and a kerosene engine, and a 35 K. W. Curtis steam turbine direct connected to a General Electric D. C. generator.

This apparatus is available for laboratory work in this course.

Senior Year, Second Semester: Two lecture periods per week for the semester and three laboratory hours per week for eight weeks.

Department of Physics.

PROFESSOR VAN NUYS.

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

Especial attention is given to the general laws underlying the science, and the history of the discovery and development of the important results is considered carefully. In the laboratory courses, the purpose is to excite in the student an interest in experimentation and to develop the ability for careful observation and the testing and sifting of results.

The courses offered by the department are as follows:

Physics 5.

Mechanics of Solids and Fluids, Sound and Light: In Mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 9. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics. The complete treatment of the latter here serves as an introduction to the study of Hydraulics in the Senior year. The work of the semester ends with a careful study of the principles of light and a discussion of the various optical instruments.

Junior Year, First Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 6.

Heat, Magnetism and Electricity: In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics in the Senior year.

The subject of electricity receives careful and detailed consideration. The laws of electrostatics, resistance, electrolysis, potential, electromagnetism, and electromagnetic induction are studied in detail, and a comprehensive consideration of electrical measuring instruments, dynamos and motors, is entered into. The course closes with a development of the laws of alternating currents and a study of alternating current machinery and transformers. This course is a necessary preparation for the course in Electrical Engineering in the Senior year.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 7.

Laboratory course to accompany Physics 5. The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity of solids, liquids and gases, acceleration of gravity, velocity and rate of vibration of sound, analysis of sounds, velocity of light; and a comprehensive study of the various optical instruments with which the laboratory is well equipped, including the photometer, radiometer, spectrometer, spectroscope, polariscope, and projection lantern, is required. The laboratory is completely equipped with apparatus for the measurement of focal length of mirrors, lenses, etc., and for spectroscopic analysis.

Junior Year, First Semester: Three laboratory hours per week.

Physics 8.

Laboratory course to accompany Physics 6: In Heat especial attention is given to the determination of calorific power of fuels, specific and latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves. The laboratory is well equipped for an extensive course in electrical testing. The apparatus includes a complete set of Weston meters, including voltmeters, millivoltmeters, ammeters, millammeters, alternating current voltmeters, electro-dynamometers, fluxmeters, magnetometers, potentiometers, permeameters, voltameters, Wheatstone bridges, many types of galvanometers, condensers, induction coils, static machine, X-Ray tubes, wireless telegraph, etc. Dynamos, motors, electric lamps of various types, are at hand for the purpose of making tests of commercial efficiency. The School machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Junior Year, Second Semester: Six laboratory hours per week.

Physics 9.

Analytic Mechanics: The theory is developed by lectures. Many problems will be solved to enforce the principles and to develop ability in the student to apply what he has learned to practical problems. Particular effort is made to cultivate the power of the student to use calculus methods when needed. The course includes the following subjects:

Statics: First principles; units, composition and resolution of concurring forces; composition and resolution of forces acting on a rigid body; conditions of equilibrium: center of gravity; friction; virtual velocities; machines; the funicular polygon and the catenary.

Kinematics: Rectilinear and curvilinear motion; composition and resolution of acceleration; angular velocity and angular acceleration; projectiles, etc.

Kinetics: Laws of motion; motion under the action of a variable force; motion in a resisting medium; constrained motion; the simple pendulum; centripetal and centrifugal forces. Impact; work and energy; moment of inertia.

Junior Year, First Semester: Three lecture periods per week.

Text Book: Bowser's Analytic Mechanics; the works of Church, DuBois, Hoskins, Johnson, Lanza, Todhunter, and Routh, are used for reference.

Department of Chemistry.

PROFESSOR COOLBAUGH MR. ANDERSON
MR. FAHRENWALD

The courses in chemistry are designed to give to mining and to metallurgical engineers the knowledge of chemistry most essential to their work. Especial emphasis is given to the laws underlying the science; the separations, estimations, etc., being made with these principles in mind. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation, and to teach the proper correlation of the results of experiments.

Chemistry 5-6.

General Chemistry: Lectures. This course is designed to give to the student a knowledge of the principal theories and laws of the science. The following subjects are discussed in an elementary way: Atoms and molecules, gases, liquids, solids, solutions, thermo- and electro-chemistry, and chemical equilibrium. Special attention is given to those portions of the subject bearing upon osmotic pressure, freezing and boiling

points of solutions, electrolytic dissociation and the law of mass action. A small amount of time is also given to the consideration of organic chemistry.

Freshman Year: Three lecture periods per week throughout the year.

Reference Books: Newth's Inorganic Chemistry; Ostwald's Principles of Inorganic Chemistry; Jones' Elements of Physical Chemistry.

Chemistry 8.

General Chemistry Laboratory: Inorganic preparations, the study of crystallization and distillation, the use of indicators, and the effect of mass upon the time and extent of reactions.

Freshman Year: Three laboratory periods per week for the second half year.

Chemistry 9-10.

Qualitative Analysis: Lectures. The work in qualitative analysis begins with an outline of the general scheme of analysis. Then follows a minute study of the metals and the acid radicals with their detections and separations. Emphasis is placed on the principles of oxidation and reduction, and the theories of ionization and hydrolysis. Separations are made before the class in order to give an idea of the correct use of reagents and of the methods for rapid manipulation.

Freshman Year, First Semester: Two lecture periods per week; second semester, one lecture per week.

Reference Books: Prescott & Johnson's Qualitative Analysis; Treadwell's Qualitative Analysis.

Chemistry 11-12.

Qualititative Analysis: Laboratory. This covers the separation of metals and acids in solutions, dry mixtures, minerals, slags, and alloys.

Freshman Year, First Semester: Nine laboratory hours per week; second semester, six laboratory hours per week.

Chemistry 13-14.

Industrial Chemistry: Lectures. The subjects considered in this course are acids, alkalis, sulphur, chlorine, bromine, idodine, cyanides, fertilizers, explosives, bricks, clays, cements, mineral paints, fuel and refractory materials.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Book: Thorp's Outlines of Industrial Chemistry.

Chemistry 15-16.

Quantitative Analysis: Lectures. The work in quantitative analysis consists of discussions of the relative merits of methods applied in the laboratory, the study of articles and reviews from chemical periodicals, and the subject of chemical calculations.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Books: Miller's Quantitative Analysis; Miller's Calculations of Analytical Chemistry; Treadwell's Quantitative Analysis; Sutton's Volumetric Analysis; Low's Technical Methods of Ore Analysis.

Chemistry 17-18.

Quantitative Analysis: Laboratory. The course covers the subject of mineral analysis, including both gravimetric and volumetric methods. The analyses required are: Magnesium sulphate, sodium or other chloride, potassium alum, coal, iron ammonium alum, iron ore, pig iron, spiegel or manganese ore, zinc ore, copper ore or matte, brass, lead ore, chromic iron, limestone, arsenic ore, antimony ore, slag, and gas analysis.

Sophomore Year: Nine laboratory hours per week throughout the year.

Chemistry 19-20.

Metallurgical Chemistry: Lectures. This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. The subjects studied are: The technical methods connected with the metallurgy of iron, steel, zinc, lead and copper; the determinations of bismuth, mercury, cadmium, tin, nickel, and the rare elements of commercial importance, and the analysis of electrolytic slimes.

Prerequisites: Chemistry 2, 3 and 4 or equivalents.

Junior Year, First Semester: Three lecture periods per week; second semester, one lecture period per week. Required of Juniors taking the metallurgical option.

Chemistry 21-22.

Quantitative Analysis: Laboratory. Work corresponding to Chemistry 19-20.

Junior Year, First Semester: Six hours per week; second semester, two hours per week.

Department of Mathematics.

PROFESSOR MCLAURY.

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the Mining Engineering Course.

No course in Alegbra is offered in the Engineering Department. However, in the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. Students who are not well grounded in algebra will be expected to take Mathematics 6, Algebra C with their freshman work.

Mathematics 7.

Trigonometry: Plane, analytical, and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trignometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week. For sixteen weeks.

Text Book: Phillips & Strong's Trigonometery.

Mathematics 8.

Analytic Geometry: This course includes the fol-

lowing subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week. For eighteen weeks.

Text Book: Nichol's Analytic Geometry, with Smith & Gale, Puckle, Ashton and C. Smith for reference.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include the discussion of a few subjects in higher algebra and will be preceded by a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Snyder & Hutchinson, Murray, and Williamson are used for reference.

Mathematics 10.

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Department of English.

PROFESSOR MCLEARIE.

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Especial emphasis is laid upon the importance of good composition in technical work. Attention is called to the

absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Wendell's English Composition; Pearson's Principles of Expression; Baldwin's College Manual of Rhetoric.

English 10.

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Economics.

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

LIST OF STUDENTS IN MINING AND METALLURGICAL ENGINEERING.

SENIOR CLASS

Anderson, William L. .....Twin Falls, Idaho.
Brooks, Floyd .....Rapid City, S. D.
Ehle, Chester G. .....Rapid City, S. D.
Muhmel, Fred J. .....Scotland, S. D.
Quinney, Elwin H. .....Alexandria, S. D.
Winsor, Frank H. .....Mitchell, S. D.
Willard, Clarence G. .....Rapid City, S. D.

JUNIOR CLASS

Dickey, S. C. .....Spearfish, S. D.
De Groot, George R. .....Salt Lake City, Utah.
Fahrenwald, Frank A. .....Rapid City, S. D.
Mosier, Peter .....Rapid City, S. D.
Schad, Hans .....Ludwigshafen, Germany.

SOPHOMORE CLASS

Alder, Alfred .....Volin, S. D.
Anderson, Amil .....Rapid City, S. D.
Henton, Hugh M. .....Spearfish, S. D.
Mara, H. W. .....Rapid City, S. D.
Pryer, W. Cristy .....Aberdeen, S. D.
Schott, Alfred M. .....Sioux City, Iowa.
Stowell, George .....Perry, Mich.

FRESHMAN CLASS

Bochert, W. C. .....St. Augustine, Florida.
Boland, William .....Keystone, S. D.
Cade, Albert F. .....Belle Fourche, S. D.
Fahrenwald, Arthur W. .....Rapid City, S. D.
Farnham, L. L. .....Sioux City, Iowa.
Hill, Robert S. .....Rapid City, S. D.
Holly, George H. .....Rapid City, S. D.
Hooper, William J. .....Virginia, Minn.
Johnson, J. Harlan .....Philadelphia, Penna.
McCauley, Willard J. .....Aberdeen, S. D.

Parker, Archie G. ..... Rapid City, S. D.
Peck, George C. ..... Henry, S. D.
Shepard, A. D. ..... Brookings, S. D.
Thiel, Arthur ..... Alexandria, S. D.
Thiel, George ..... Alexandria, S. D.
Tobey, Frank ..... Memphis, Tenn.
Wheelock, Clarence ..... Rapid City, S. D.

SPECIAL STUDENTS

Ballard, Peter A. ..... Rapid City, S. D.
Bentley, Chas. ..... Deadwood, S. D.
Mainell, H. J. ..... Iron Mountain, Mich.
Narkaus, W. E. ..... Prairie City, Oregon.
Newport, Glenn H. ..... Bisbee, Ariz.

PREPARATORY STUDENTS

Alder, Herbert ..... Volin, S. D.
Anderson, Georgia ..... Rapid City, S. D.
Anderson, Leon ..... Rapid City, S. D.
Blair, Ben ..... Rapid City, S. D.
Booth, Lionel E. ..... Virginia, Minn.
Borst, O. H. ..... Pierre, S. D.
Cassilly, Tom ..... Rapid City, S. D.
Chapman, Gladys ..... Rapid City, S. D.
Coursen, Ruth ..... Rapid City, S. D.
Drake, Rollin H. ..... Lethbridge, Alberta, Canada.
Gale, Lysle ..... Rapid City, S. D.
Hartgering, Frances ..... Rapid City, S. D.
Hill, Joseph H. ..... Rapid City, S. D.
Holly, Maurice ..... Rapid City, S. D.
Johnson, Raymond ..... Rapid City, S. D.
Lanphere, Clarence ..... Rapid City, S. D.
Lenhart, W. G. ..... Rapid City, S. D.
Lenhart, W. B. ..... Rapid City, S. D.
McElroy, Jack ..... Rapid City, S. D.
Moore, George ..... Rapid City, S. D.
Napier, Floyd ..... Rapid City, S. D.
Platt, Edward ..... Rapid City, S. D.
Rugg, Harold ..... Rapid City, S. D.

Smith, Elwyn ..... Rapid City, S. D.
Soule, Zelia ..... Rapid City, S. D.
Van Nuys, Laura B. ..... Rapid City, S. D.

ALUMNI OF THE SOUTH DAKOTA STATE SCHOOL OF MINES.

Eighteen Hundred Eighty-eight.

John W. Hancher, B. S., M. A. With National Packing Co., Mexico City, Mex.

Eighteen Hundred Ninety.

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S., Western Representative, Gerhard-Mennen Chemical Co., Newark, N. J.

Eva Robinson, B. S., M. A. Supervisor of the Domestic Science Department, University of Chicago, Chicago, Ill.

Eighteen Hundred Ninety-one.

Ottilie H. Behrens, B. S., Rapid City, S. D.

Nineteen Hundred One.

G. Howell Clevenger, B. S., E. M., South Dakota School of Mines; M. A., Columbia University. Associate Professor of Metallurgy, Stanford University, Calif.

Max Hopkins, B. S. With International Correspondence School of Scranton, Pa. Address, 1651 Jefferson Ave., St. Louis, Mo.

Nineteen Hundred Two.

Areli C. Overpeck, B. S., E. M. Superintendent, Dakota-Calumet Mining Co., Hill City, S. D.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four.

U. S. S. Arentz, B. S., E. M. Superintendent Nevada Douglas Copper Co., Yerrington, Nev.

Arthur E. Hall, B. S., Met. E. Assistant Superintendent, Copper Department, American Smelting & Refining Co., Omaha, Nebr.

Elmer W. West, B. S., M. E. Engineer, Nevada-Omaha Mining & Milling Co., Bannock, Nev.

Guy E. Wolcott, B. S. Mining Engineer, Golita, Calif.

NINETEEN HUNDRED FIVE.

O. Allen Anderson, B. S., E. M. Mining and Metallurgical Engineer, Salmon City, Idaho.

James Halley, Jr., B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Engineer, Oliver Iron Mining Co., Mountain Iron, Mich.

NINETEEN HUNDRED SIX.

Louis L. Penhoel, B. S. Superintendent, Dexter Mining and Development Co., Atlantic City, Wyo.

Peter Whytock, B. S. Consulting Engineer, Key Gold Mining Co., 60 State St., Boston, Mass.

William Gaines, B. S. Engineer, Leesburg Mining Co., Leesburg, Idaho.

B. D. O'Brien, E. E., Rose Polytechnic, 1896; B. S., E. M., South Dakota School of Mines. Superintendent, Leesburg Mining Co., Leesburg, Idaho.

Frederick Wetherald, B. S., Boston, Mass.

Earl Van L. Smith, B. S. Assayer, New York, Honduras Rosaria Min. Co., San Juancito, Hond.

Edwin Coolidge, B. S., E. M. Mill Superintendent, Cumberland Mining Co., Maiden, Mont.

Herbert Seiter, B. S. Mining Engineer, Ekalaka, Mont.

Harry T. Curran, B. S., E. M. Manager, Los Ailes Mining Co., Ayutla, Mex.

J. Burns Read, B. S., E. M. Mining and Metallurgical Engineer, Salmon City, Idaho.

NINETEEN HUNDRED SEVEN.

Frank Bryant, B. S. Mine Foreman, Leesburg Mining Co., Leesburg, Idaho.

Frank Anderson, B. S. Engineer, Portland, Oregon.
Wharton Cornell, B. S., 1711 Rodney St., Wilmington, Del.
Otto Ellerman, B. S., Cherry, Arizona. Metallurgist for Federal Mining and Milling Co.
Bernard Matson, B. S., Imlay, S. D.
Lloyd Mellinger, B. S. Assayer and Chemist, Mountain Copper Co., Martinez, Calif.
Milton Morris, B. S., Rapid City, S. D.
C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M., Columbia University. Professor of Physics, South Dakota School of Mines, Rapid City, S. D.
Charles Whitmore, B. S. Cashier Lincoln County Bank, Canton, S. D.
Leon Peck Wells, B. S. Engineer, Calumet and Arizona Mining Co., Box 1433, Bisbee, Ariz.

Nineteen Hundred Eight.

Cyril Colledge, B. S. With Rosario Mining Co., San Jauncito, Honduras, C. A.
L. L. Hebblethwaite, B. S., 907 Lake St., Evanston, Ill.
Glen P. Ives, B. S. Mining Engineer, Box 962, Santiago, Chile.
Lem S. Overpeck, B. S. Assistant Engineer, Amalgamated Copper Co., Anaconda, Mont.
D. C. Woodard, B. S. Assayer and Metallurgist, Cassila 962, Santiago, Chile.
Fred W. Winters, B. S. With Cumberland Mining Co., Maiden, Mont.
W. G. Sparling, B. S., Rapid City, S. D.
Ignacio Diaz Ossa, B. S. Assayer and Metallurgist, Cassilla 962, Santiago, Chile.
Ivan E. Goodner, B. S. Cyanide Chemist, Alaska-Treadwell Gold Mining Co., Treadwell, Alaska.

Nineteen Hundred Nine.

Jesse O. Betterton, B. S. Assistant Chemist, American Smelting and Refining Co., Omaha, Nebr.

Roy F. Coolidge, B. S. Mill Superintendent, Kendall Gold Mining Co., Kendall, Mont.

Eli A. Hvistendahl, A. B., Unversity of South Dakota; B. S., South Dakota School of Mines, Vermillion, S. D.

H. W. Jones, A. B., University of South Dakota; B. S., South Dakota School of Mines. Science Department, Jamestown High School, Jamestown, N. D.

Lewis W. Ledyard, B. S. Draftsman, Homestake Mining Co., Lead, S. D.

Willard C. Marshall, B. S., Rapid City, S. D.

Herbert N. Read, B. S. Chemist, Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Ten.

Richard T. Bennett, B. S. United States Deputy Mineral Surveyor, Rapid City, S. D.

John Wasson Eddy, B. S., Helena, Mont.

John Wing Elliott, B. S. With Leesburg Mining Co., Leesburg, Idaho.

George Earl Flower, B. S. Millman, Lundberg, Dorr & Wilson, Terry, S. D.

Zay Jeffries, B. S. Mine Reporter, Custer, S. D.

Arthur E. Sargent, B. S. Assayer, Lundberg, Dorr & Wilson, Terry, S. D.

John William Stoner, B. S. Assayer, Cumberland Mining Co., Maiden, Mont.

Joseph H. Saville, B. S. With Golden Slipper Gold Mining and Milling Co., Hill City, S. D.

Harry Ellis Wheelock, B. S. Mine Surveyor, Socorro Mining Co., Mogollon, New Mexico.

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Annual Catalog 1912-1913

With Announcements for 1913-1914

Rapid City, So. Dak.
May 1913

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JULY.

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SEPTEMBER

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DECEMBER.

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JANUARY.

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SEPTEMBER

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NOVEMBER.

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DECEMBER.

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SOUTH DAKOTA STATE SCHOOL OF MINES

The South Dakota State School of Mines

Annual Catalog
1912-13
With Announcements for 1913-14

A. J. W.

THE DAILY JOURNAL
RAPID CITY, S.D. DAK.

College Calendar

1913

Registration Committee considers applications for advanced standing and credentials for admission ..... September 16

School Year begins..... Wednesday, September 17

Thanksgiving Recess.... November 27 to 29 inclusive

Christmas Vacation begins ..... December 22

1914

Christmas Vacation ends ..... January 3

Short Course begins ..... January 5

Midyear Examinations .... January 26 to 31 inclusive

First Semester ends ..... January 31

Second Semester begins ..... February 2

Short Course ends ..... February 14

Washington's Birthday ..... February 22

Annual Field Trips ..... April 6 to April 13

Baccalaureate Sermon ..... May 24

Final Examinations ..... May 25 to 30 inclusive

Faculty Reception ..... May 26

Commencement and Conferring of Degrees.. May 27

Regents of Education

Members of the Board.

THEODORE W. DWIGHT, Sioux Falls.
Term Expires January 1, 1915.
A. E. HITCHCOCK, Mitchell.
Term Expires January 1, 1915.
ALBERT M. ANDERSON, Sturgis.
Term Expires January 1, 1917.
M. P. BEEBE, Ipswich.
Term Expires January 1, 1919.
AUGUST FRIEBERG, Beresford.
Term Expires January 1, 1919.

Officers of the Board.

A. E. HITCHCOCK, President, Mitchell.
FRED FORD, Secretary, Elk Point.
A. W. EWERT, (State Treasurer),
Treasurer Ex-officio.

Regents Committee in Charge of the School of Mines.

A. M. ANDERSON A. E. HITCHCOCK

Faculty

Cleophas Cisney O'Harra, President and Professor of Geology.
A. B., Carthage College; Ph. D., Johns Hopkins University.

Howard Lincoln McLaury, Professor of Mathematics.
A. B., Oberlin College; A. M. Harvard University.

Mark Ehle, Professor of Mining.
E. M., Colorado School of Mines.

Melville Fuller Coolbaugh, Professor of Chemistry.
B. S., Colorado College; A. M., Columbia University.

Claude Cornelius Van Nuys, Professor of Physics.
A. B., Yankton College; B. S., E. M., South Dakota State School of Mines; A. M., Columbia University.

Joseph Herbert Steele, Professor of Engineering.
B. S., Michigan Agricultural College.

John McLearie, Professor of English.
A. B., Macalester College; A. M., University of Chicago.

Clarence Leslie Lewis, Lecturer on Mining Law.
University of Michigan.

Howard Magill German, Assistant Professor of Metallurgy.
B. S., E. M., Pennsylvania State College.

Victor Ziegler, Assistant Professor of Mineralogy and Petrography.
A. B., University of Iowa; A. M., Columbia University.

CHRISTIAN TRYGSTAD, Instructor in Modern Languages and History.
A. B., St. Olaf College; A. M., University of Minnesota.

HUGH W. TALBOT, Instructor in Preparatory Science and Mathematics.
B. S., Colgate University.

DELLA MAY HAFT, Librarian.
Ph. B., University of Chicago.

LULU QUIST, Registrar and Secretary to the President.

WILLIAM A. COURSEN, Superintendent of Buildings and Grounds, and Instructor in Machine Shop.

Other Employees.

HUGH HENTON, Student Assistant in Chemistry.

ALFRED ALDER, Student Assistant in Chemistry.

AMIL ANDERSON, Student Assistant in Metallurgy.

W. C. BOCHART, Student Assistant in Geology.

ROBERT S. HILL, Student Assistant in Physics.

MRS. A. O. ANDERSON, Janitor.

FRANK BOYD, Fireman.

Standing Committees of the Faculty

Committee on Admission and Registration:

Professor Ehle, Chairman.
Professor Steele
Professor Van Nuys
Mr. Trygstad

Committee on Theses and Degrees:

Professor German, Chairman
Professor Coolbaugh
Professor McLaury
Professor Ziegler

Committee on Emergencies:

Professor Coolbaugh, Chairman
Professor Ehle
Professor McLaury
Professor McLearie
Professor Steele
Professor Van Nuys

Committee on Athletics:

Professor Ziegler, Chairman
Professor McLearie
Professor Ehle
Professor German

Committee on School Magazine:

Professor McLearie, Chairman
Professor Ziegler
Mr. Trygstad

Committee on Catalog:

PROFESSOR STEELE, Chairman
PROFESSOR GERMAN
MR. TALBOT

Committee on Library:

PROFESSOR COOLBAUGH, Chairman
PROFESSOR VAN NUYS
MR. TALBOT
MISS HAFT

Committee on Student Welfare:

PROFESSOR MCLAURY, Chairman
PROFESSOR VAN NUYS
MR. TALBOT
MR. TRYGSTAD

Board of Control of the Athletic Association:

PROFESSOR EHLE, Chairman.
MR. ROBERT HILL, Secretary
PROFESSOR MCLEARIE
PRESIDENT O'HARRA
MR. ALFRED ALDER
MR. O. H. BORST
MR. W. R. PUTNAM

PROFESSOR MCLAURY, Secretary of the Faculty.
DR. G. C. REDFIELD, Football Coach

The regular meeting of the faculty is held on the first Friday of each month, at 3:45 P. M.

THE
JOHN CREAR
LIBRARY

RAPID CITY, LOOKING NORTHWEST

General Statement

Establishment of the School.

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate, and have control of the various public institutions of learning maintained wholly, or in part, by the State as State Institutions.

The following is an extract from the act of the legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States, and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School.

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the State will be aided. Whenever it is possible, the School also aids the development of the mineral resources by the investigation of mining and metallurgical problems which arise in the state. At the present time, many graduates of the School are employed in responsible positions in the Black Hills and throughout the West generally, and are doing much toward the development

of the state's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting, and to cyanidation.

Recent demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this School together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. These may be obtained by those interested, upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratory, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school, however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that purpose. In 1903 $18,000 was appropriated by the legislature for a rear addition, and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the Preparatory Building, $2,500 for replace-

ments in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment, at the present time, is such as to give good facilities for thorough instruction in mining and metallurgy, and allied subjects.

Location.

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central Northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit with its particular and sometimes striking color yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse, bare granite risinng from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canyons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here

and there by the stately somber forms of porphyry buttes, there is presented a view well worth many hardships to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock-raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The total mineral production since the first mining in 1875 is approximately $190,000,000.

In addition to the natural features of the region, the political, social, educational, and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and North-Western railway, the Chicago, Burlington and Quincy railway, and the Chicago, Wilwaukee and St. Paul railway. Rapid City is on the line of the Chicago and North-Western connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state

through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 4,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid creek 3200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and bustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work

following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but, to the energetic student, is also a source of ready cash.

Buildings and Equipment

Buildings and Grounds.

The buildings in which the work of the School is carried on are four in number: First, the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which students found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and the Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Engineering. The chemical laboratories comprise the general, qualitative, and quantitative laboratories, with balance room, supply rooms, lecture room, and office, together with a private laboratory for the professor in charge. The Department of Engineering consists of instructor's office, two large drawing rooms, a lecture room, supply rooms, and a room equipped for making

blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop. The machine shop enables the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plain, two stories high, built of red brick covered with stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horse-power of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines direct connected to direct current generators. A third turbine unit similar to the above but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

RELIEF MAP OF THE BLACK HILLS

Equipment.

In general, the school is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

Library.

The library and reading room occupy a large, well lighted and well equipped room on the first floor of the Main Building. Here are found the standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Economics, and many works of a general nature.

Authoritative scientific journals published in the United States, Canada, Mexico, England, and Germany are found on the reading tables and are bound when volumes are completed—putting in substantial form the latest research in the sciences taught in this school. Some of these sets are complete, such as the *American Journal of Science,* consisting of one hundred eighty-two volumes; *Journal of Geology,* nineteen volumes; *Journal of Society of Chemical Industry,* thirty volumes. Others, such as *Engineering and Mining Journal, Mining and Scientific Press, Mines and Minerals,* are nearly complete and are being completed as rapidly as possible.

The publications of the learned societies of the United States and England are represented by Proceedings of the Royal Society of London, of the Institution of Mining and Metallurgy, of the Institution of Mining Engineers, of the Iron and Steel Institute, and of the American Institute of Mining Engineers.

The library is the repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

A library of four hundred volumes has been loaned to the school by the Rapid City Library Association.

This collection contains works on literature, history and science.

The Dewey system of classification is used and a card index gives author, title and subject.

The privileges of the Library are extended to those not attending the college who may find use for its books of reference.

Drawing Rooms.

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. The drawing rooms are well lighted by many windows. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories.

There are three chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, and one for quantitative analysis. The last two laboratories are equipped with large individual desks with title tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate balance room in which are analytic balances of standard makes, among them Becker's and Troemner's. There is also a private laboratory for the professor of Chemistry.

The apparatus is ample for all mineral, alloy and

rock analysis, and includes combustion furnaces, apparatus for gas analysis, facilities for electrolytic precipitations, calorimeters for fuel analysis and spectroscopes for qualitative experiments.

Biological Laboratory.

In the Biological Laboratory many new pieces of apparatus have recently been added to the equipment. Among them is a large Alberene stone aquarium with plate glass sides in which are kept aquatic plants and animals for the study of their interrelations and their habits of growth and reproduction. Small balanced aquaria are also maintained for this purpose. The equipment is modern, including compound microscopes with accessories, sterilizers, a triple-walled incubator, charts, and adequate apparatus for technique. The museum collection is suitable for botanical and zoological purposes.

Physical Laboratory.

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundation for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, reciprocating and mercury air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity; Steinheil spectroscope, large vernier spectrometer; complete apparatus for measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for calorimetric determinations of specific heat, heat of combustion, heat of vaporization, etc.; Dalton's apparatus; complete apparatus for the determination of the mechanical equivalent of heat; seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, and a

complete line of instruments for electrical measurements, including Weston voltmeters, ammeters, wattmeters, Leeds and Northrup potentiometer, wheatstone bridges, condensers, electro-dynamometers, hot wire meters, Weston and Cambridge Scientific Company galvanometers, electrometers, magnetometers, voltameters, fluxmeters, permeameters, and Woulff precision resistances and Leeds and Northrup variable inductance; also completely equipped switchboards for both high and low voltage distribution of alternating and direct current, made by Max Kohl of Germany; and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; motor generator set, and a variety of dynamos and motors, gasoline engines, induction machines, and models of steam and gas engines.

In addition to the above, the school heating and lighting plant, and the equipment of the Departments of Mining and Metallurgy afford the student opportunity of making tests on dynamos and motors, engines and turbines of commercial sizes.

The school also possesses a completely equipped wireless telegraph station, consisting of a sending set of 1 K. W. capacity and a sensitive receiving set for long distance messages. The laboratory is well equipped with tools and work benches for the construction of special apparatus.

Assay Laboratory.

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These

are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fire-proof. There is a melting furnace using coke, and gasoline furnaces made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mill makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire samples for close checking work.

Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 19 and 21, and the other in which the various metallurgical processes are performed on a commercial scale.

The expermental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance

pyrometer, Parr and Mahler-Bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead, and is best adapted to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10 x 2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ in. centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The smelting machinery consists of a 30 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory.

This laboratory is equipped with six metallographic

microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat treatments and for metallography.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus by the department, upon the payment of a small fee. Each student his his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum.

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a store house of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double-door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis Exposition, also a very valuable and unique rock section of the Homestake mine, donated by the Homestake Mining Company of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards of hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining

and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The School is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops.

In the basement of the Main Building a small machine shop is provided, containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for the design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the upper classes are granted permission to use the facilities offered by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications.

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Nine have been published. They are as follows:

Bulletin No. 1.—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources

and Mills of the Black Hills of Dakota; 171 pages. 1888. (*Out of print.*)

By F. R. Carpenter and H. O. Hofman.

Bulletin No. 2.—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages. 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3.—Cyanide Experiments on the Silicious Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4.—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. (*Out of print.*) By C. C. O'Harra.

Bulletin No. 5.—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902.

By C. H. Fulton.

Bulletin No. 6.—The Mineral Wealth of the Black Hills; 88 pages. 1902. (*Out of print.*)

By C. C. O'Harra.

Bulletin No. 7.—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904.

By C. H. Fulton.

Bulletin No. 8.—The Cement Resources of the Black Hills. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle, Jr., and C. H. Fulton.

Bulletin No. 9.—The Badland Formations of the Black Hills Region; 152 pages. 1910.

By C. C. O'Harra.

The Pahasapa Quarterly. This is a magazine published by the students with the assistance and general supervision of the faculty. As its name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

Students' Expenses

Tuition.

The tuition and incidental fee is $6 per semester, or $12 per year, *payable in advance on registration.* This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said Senator or Representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratituity whatever."

Fees.

Fees enumerated below cover the bare cost of materials and supplies consumed in the laboratories and loss due to breakage, etc.

All fees are payable at the beginning of each semester, on registration. (Consult Departments of Instruction for description of courses.)

Chemistry 3-4, Elementary Chemistry, per semester	$ 4.00
Chemistry 11-12, Qualitative Analysis, per semester	7.00
Chemistry 17-18, Quantitative Analysis, per semester	8.00
Chemistry 21-22, Metallurgical Analysis, per semester	8.00

Metallurgy 24, Assaying, per semester	25.00
Metallurgy 19-21-22, Metallurgical Laboratory, per semester	5.00
Metallurgy 11, Metallography	5.00
Mineralogy 1, General Mineralogy, per semester	5.00
Mineralogy 2, Blow-pipe Analysis, per semester	5.00
Geology 3-4, Petrography, per semester	2.00
Physics 3-4, Elementary Physics, per semester	1.00
Physics 7-8, Advanced Physics, per semester	2.00
Engineering 1-2, Mechanical Drawing, per year	1.00
Engineering 3-4, Descriptive Geometry, per year	1.00
Engineering 5-6, Surveying, per semester	3.00
Engineering 9, Machine Design	1.00
Preparatory Science, per semester	2.00
Chemistry, all courses, deposits to cover breakage, etc.	5.00
Metallurgy, all courses, deposits to cover breakage	5.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Athletic Association Fee, per year	5.00
Fee for permit for "conditioned" examination	2.00

(Note.—No platinum is furnished by the Department of Chemistry.)

Other Expenses of the Nature of Fees.

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately, $7.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of insruments.

Engineering 3-4, Mechanical Drawing, will cost approximately $4.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $3.00 for the year.

Living Expenses.

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $4.50 upwards, per week. This makes the expense for board and room for the school year of 37 weeks range from $185 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books.

Freshman year	$13.00
Sophomore year	17.00
Junior year	23.00
Senior year	19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshman year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added according to individual taste.

Incidental Expenses.

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshmen year usually costs the student about $10. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help.

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

Students' Organizations and Athletics

The student organizations are the Students' Association and the Athletic Association. The Students' Association has for its aim the general welfare of the student body. The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basketball teams, and track athletics. Membership in this association is obligatory, all students paying the annual fee of $5.00. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits.

Conduct

The school has no codified rules of conduct. Students are held to a strict account of their work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

Determination of Minerals and Assaying

Minerals are determined free of charge. Assays for gold and silver, etc., and chemical analyses both quantitative and qualitative, are made at reasonable rates. Prices will be sent upon application. All samples for analysis or assay and letters accompanying same should be addressed to the President of the School.

Requirements for Admission

Freshman Class.

Requirements for admission to the Freshman class are as follows:

Fourteen units are necessary for entrance.

Required Units.

Arithmetic	1	unit
Algebra	1.5	units
Plane Geometry	1	unit
Solid Geometry	0.5	unit
English	2	units
History	1	unit
Physics	1	unit
Chemistry	1	unit
Total required units	9	units

Elective Units.

German	1, 2 or 3	units
French	1, 2 or 3	units
Latin	2, 3 or 4	units
Greek	1	unit
Spanish	1 or 2	units
English	1 or 2	units
History	1 or 2	units
Mathematics	0.5	unit
Science	1 or 2	units
Drawing	1	unit
Shop Work	1	unit
Civil Government	0.5	unit
Bookkeeping	1	unit
Elective units required for entrance...	5	units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School.

First: By Certificate. Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Second: By Examination. All other candidates for admission to the regular engineering courses will be required to pass entrance examinations in the subjects specified. These examinations are held at Rapid City on dates mentioned in the calendar. Students who are deficient in subjects required for entrance into the regular engineering courses are permitted to enter the Preparatory Department, maintained by the school for the special purpose of preparing students so deficient.

Credentials for entrance should be in the hands of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units.

Mathematics: The four and one-half units which may be offered in mathematics are as follows:

Arithmetic—One unit, complete, including the metric system.

Algebra—One and one-half units. The equivalent of A, B and C algebra described under Preparatory Mathematics in the Preparatory Catalog.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Two units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Catalog.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Catalog.

History—One unit. The History of the United States, English or Ancient History, as described under History, in the Preparatory Catalog.

Elective Units.

The equivalent of courses, not mentioned above, described under Mathematics (Trigonometry only). Languages, History, English and Preparatory Science, in the Preparatory Catalog.

Special Students.

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire,

taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses, particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

Short Course.

A Short Course, of six weeks duration, will be offered hereafter, beginning each year with the assembling of school after the Christmas vacation. This course is designed for prospectors and miners and other men of maturity who have had practical experience, but who have had no opportunity to acquire a technical education. For such men the school offers, during the midwinter weeks, an opportunity to gain some insight into those principles of their work which practice alone will not provide. Instruction is given in the following subjects: Assaying, Cyaniding, Chemistry, Mineralogy, Geology, Ore Dressing and Mining Law. The tuition fee, payable at time of registration, will be six dollars plus the cost of such materials as may be used up in the laboratories.

A feature of interest is that men having ores or minerals of their own will be given opportunity to make tests upon them in so far as such can be done without interfering with the other work of the institution. Every effort will be put forth to make this work both practical and helpful. No credit toward a degree will be given for work pursued in this course.

Summer School.

The summer school begins immediately after commencement. Three weeks are devoted by the Junior class to surveying in the field and underground, and

one week by the Senior class to visits to mines and metallurgical works.

Preparatory Department.

The School of Mines finds it necessary to maintain a Preparatory Department on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester. Small fees ranging from $1 to $4 are required in Physics, Biology and Chemistry.

A special catalog describing the Preparatory Department is published and will be sent on application.

Admission to Advanced Standing.

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decides these cases upon the basis of individual merit.

Degrees.

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgi-

cal Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years' successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineers' degrees should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Preparatory Department will receive, therefor, the usual diploma.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree. This thesis will be assigned to the individual members of the Senior class by a special thesis committee of the faculty. The standard form of thesis shall be the working out of plans for the development of an hypothetical mine, such subject to be assigned to all students except that the thesis committee may vary the subject as its judgment dictates. Report of progress in thesis work must be made at stated intervals to the

theses committee. Theses must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning theses are fully satisfied.

The following is a list of the theses submitted since 1903:

1904. Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

1905. Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

1906. Coolidge, E. B., and Gains, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T., and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

1907. Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.
Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.
Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines Including Metallurgical Treatment.
Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.
Van Nuys, C. C. Plane Curves.
Wells, L. P., and Whitmore, C. F. Report on the Coolgarde Group of Claims, Ida Gray Mining District.

1908. Coolidge, Cyril, and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.
Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.
Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.
Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

1909. Betterton, J. O. The Determination and Separation of Antimony and Arsenic.
Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.
Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.
Ledyard, L. W. The Cleopatra Mine.

1910. Eddy, John W., and Bennett, R. T. A Hypothetical Mine.
Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.
Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of Its Ore.

Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

1911. Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

1912. Dickey, S. C., and Mosier, P. M. Preliminary Treatment in the Concentration of an Argentiferous Copper Ore.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

Courses and Departments

The courses given by the School of Mines are:
Mining Engineering Course .....4 years
Metallurgical Engineering Course .....4 years

SYNOPSIS OF COURSES

Mining Engineering Course.

FIRST YEAR

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry.....	48	
Chemistry 9, 11—Qualitative analysis..	32	144
Geology 1—General geology	64	48
Engineering 1—Mechanical drawing...		96
English 9—Composition	64	
	288	288
Hours per week.....	18	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry.....	80	
Chemistry 6, 8—General chemistry.....	48	48
Chemistry 10, 12—Qualitative analysis..	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing...		96
English 10—Composition	64	
	272	288
Hours per week.....	17	18

SECOND YEAR

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry....	32	
Chemistry 15, 17—Quantitative analysis	32	144
Mineralogy 1—General mineralogy.....	48	48
Engineering 3—Descriptive geometry...		96
Engineering 5—Surveying	48	48
	240	336
Hours per week.....	15	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis	16	96
Engineering 4—Descriptive geometry		48
Engineering 6—Surveying	24	48
Metallurgy 2—General metallurgy	48	
Mining 2, 4—Mine surveying	24	Summer
	256	336
Hours per week	16	21

THIRD YEAR

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	
Geology 3—Physical geology	48	
Mineralogy 3—Optical mineralogy	16	48
Engineering 7—Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	312	288
Hours per week	19½	18

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Engineering 14—Mechanics of materials	64	
Geology 4—Petrography	48	48
Economics	48	
Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking	48	
	320	336
Hours per week	20	21

FOURTH YEAR

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Geology 5—Economic geology	64	
Mining 7—Drainage, transportation	32	
Mining 9—Shaft sinking, exploitation	48	
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Iron and steel	32	
Mining 11—Mine design		96
Mining 13—Mining law	16	
Metallurgy 19—Laboratory		48
Thesis		48
	304	240
Hours per week	19	15

Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics	32	
Engineering 18—Hydraulics	32	24
Geology 6—Economic geology	64	
Mining 8—Mine administration	32	
Mining 10—Ventilation and lighting, placer mining, mine examination	48	
Metallurgy 8—Copper and lead	32	
Engineering 20—Power plants	32	24
Mining 12—Mine designing		96
Mining 14—Mine accounting		32
Metallurgy 20—Mill run		48
Thesis		96
	272	320
Hours per week	17	20

Metallurgical Engineering Course.

FIRST YEAR

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9, 11—Qualitative analysis	32	144
Geology 1—General geology	64	48

Engineering 1—Mechanical drawing...		96
English 9—Composition	64	
	288	288
Hours per week.....	18	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry....	80	
Chemistry 6, 8—General chemistry	48	48
Chemistry 10, 12—Qualitative analysis..	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing...		96
English 10—Composition	64	
	272	288
Hours per week.....	17	18

SECOND YEAR

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry....	32	
Chemistry 15, 17—Quantitative analysis	32	144
Mineralogy 1—General mineralogy.....	48	48
Engineering 3—Descriptive geometry..		96
Engineering 5—Surveying	48	48
	240	336
Hours per week.....	15	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry....	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis.....	16	96
Engineering 4—Descriptive geometry...		48
Engineering 6—Surveying	24	48
Mining 2, 4—Mine surveying	24	Summer
Metallurgy 4—General metallurgy.....	80	
	288	336
Hours per week.....	18	21

THIRD YEAR

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	
Chemistry 19, 21—Quantitative analysis	48	96
Engineering 7—Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	296	336
Hours per week	18½	21

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Engineering 14—Mechanics of materials	64	
Chemistry 20, 22—Quantitative analysis	16	32
Economics	48	
Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking	48	
	288	320
Hours per week	18	20

FOURTH YEAR

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Iron and steel	32	
Metallurgy 11—Metallography	16	48
Metallurgy 13—Electrometallurgy	32	
Metallurgy 15—Zinc and minor metals	32	
Metallurgy 17—Metallurgical design		96
Metallurgy 21—Metallurgical laboratory		96
Mining 13—Mining law	16	
Mining 7—Drainage, transportation	32	

Thesis		48
	272	336
Hours per week	17	21

Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics	32	
Engineering 18—Hydraulics	32	24
Engineering 20—Power plants	32	24
Metallurgy 6—Gold and silver	48	
Metallurgy 10—Copper and lead	80	
Mining 14—Mining accounting		32
Metallurgy 18—Metallurgical design		48
Metallurgy 20—Mill run		48
Metallurgy 22—Metallurgical laboratory		96
Mining 8—Mine administration	32	
Thesis		96
	256	368
Hours per week	16	23

Preparatory Science Course.

FIRST YEAR

First Semester—	Lectures	Lab.
Civil Government	5	
English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient History	5	
Wood Shop		6
	18	9

Second Semester—	Lectures	Lab.
Arithmetic	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediaeval history	5	
Wood Shop		6
	18	9

SECOND YEAR

First Semester—	Lectures	Lab.
Mathematics 1—Algebra	5	

English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Machine Shop		3
	18	6

Second Semester—	Lectures	Lab.
Mathematics 2—Algebra	5	
English 4—Rhetoric	5	
History 4—U. S. history	5	
Biology 4—Botany	3	3
Machine Shop		3
	18	6

THIRD YEAR

First Semester—	Lectures	Lab.
Mathematics 3—Geometry	5	
German 1	5	
Biology 5—Zoology	3	6
English 5 or 7—English or American Literature	5	
Freehand Drawing		3
	18	9

Second Semester—	Lectures	Lab.
Mathematics 4—Geometry	5	
German 2	5	
Astronomy	3	3
English 6 or 8—English or American Literature	5	
Physical Geography	3	3
Freehand Drawing		3
	21	9

FOURTH YEAR

First Semester—	Lectures	Lab.
Chemistry 1-3	3	6
German 3	5	
Physics 1-3	4	6

Mathematics 5—Geometry	5	
	17	12
Second Semester—	Lectures	Lab.
Chemistry 2-4	3	6
German 4 or 6	5	
Physics 2-4	4	6
Mathematics 6—Algebra	5	
	17	12

Department of Geology and Mineralogy

Professor O'Harra, Assistant Professor Ziegler

Library, Laboratory and Field Facilities.

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, endesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to near-by points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and

laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2.

PROFESSOR O'HARRA

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical, and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing an the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand

how to interpret facts gained in the study of economic deposits.

Freshman Year: Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Chamberlain and Salisbury's College Geology.

Mineralogy 1.

ASSISTANT PROFESSOR ZIEGLER

General Mineralogy: This course is planned to develop such information as may be needed for the quick and accurate determination of mineral species in the field. The course is based on lectures and laboratory work and embraces frequent rigid quizzes on features of chief importance. The physical properties of minerals are dealt with in the early part of the course; a brief study of crystallography introduces this part of the subject. This is followed by a careful physical study of the chief economic and other minerals, except silicates, in systematic order. Good collections, containing most of the common species of minerals and many of the rare ones, are arranged for convenient use in the museum and the laboratory. Every student is expected to identify a collection of about 1500 unlabeled minerals; in addition, throughly accurate observation of labeled specimens from many localities is insisted upon, and every attention is given to simple practical methods in the determination of unknown minerals.

Sophomore Year, First Semester: Three lecture periods and three laboratory hours per week.

Text Book: Moses and Parson, Mineralogy, Crystalography, and Blow-pipe Analysis.

Mineralogy 2.

ASSISTANT PROFESSOR ZIEGLER

General Mineralogy and Blow-pipe Analysis: This course is a continuation of course 1 and has the same object in view, i. e., the teaching of quick methods of

mineral determination. In the lecture work the silicates are taken up in systematic order, special attention being given to the rock making minerals, such as the feldspars, feldspathoids, pyroxenes, amphiboles, etc., their relationship, methods of formation, occurrence in nature, and association. A summary of the gem minerals, and the secondary silicates is included. In the laboratory work, the first third of the semester is devoted to the study of blow-pipe methods, known minerals being used. After this, the student is given only unlabeled specimens, the nature and name of which he is required to learn, keeping for reference a detailed record of all results obtained. It is expected that, upon completing this and the preceding course, the student will have gained a fair working knowledge of approximately two hundred of the common minerals, including the chief features of their distribution, uses, value, and output.

Sophomore Year, Second Semester: One lecture period and six laboratory hours per week.

Text Book: Brush and Penfield, Determinative Mineralogy and Blow-pipe Analysis.

Mineralogy 3.

ASSISTANT PROFESSOR ZIEGLER

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference; the different media and their wave fronts, optical signs, and indicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent "Zeiss" microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sec-

tions manufactured by Krantz. Practice is given in the making of thin sections.

Junior Year, First Semester, Mining Engineering Option: One lecture period and three laboratory hours per week.

Text Book: Luquer, Minerals in Rock Sections.

Geology 3.

ASSISTANT PROFESSOR ZIEGLER

Physical Geology: The purpose of this course is to bring out in some detail certain important features, too briefly considered in General Geology, that have a close connection with the subjects of Petrography and Economic Geology, which follow. The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations, is next taken up followed by a brief summary of the modern ideas on diastrophism, including earthquakes, folding, and faulting. The physical action of underground water, its circulation, and its influence on the rocks receive careful attention. Thus, processes of denudation, and deposition, and the formation and the classification of sedimentary rocks are emphasized. In this as well as in other courses those factors having a direct bearing on Petrography and Economic Geology will receive particular attention.

Junior Year, First Semester, Mining Engineering Option: Three lecture periods per week.

Text Book: Lecture Notes.

Geology 4.

ASSISTANT PROFESSOR ZIEGLER

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rock, both under the microscope and in hand specimens. The

lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Zirkel and Rosenbusch, modified as in use in America, which is followed by a brief summary of the Quantitative System. The origin, distribution, mode of occurrence, and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, Second Semester, Mining Engineering Option: Three lecture periods, and three laboratory hours per week.

Text Book: Kemp, Handbook of Rocks. Luquer, Minerals in Rock Sections. Lecture Notes.

Geology 5-6.

PROFESSOR O'HARRA

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products,

such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology of the United States; Kemp's Ore Deposits of the United States and Canada.

Department of Mining

Professor Eihle

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to near-by mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mining region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, has been completely overhauled and re-equipped with modern apliances of approved design. The operations attendant upon the preliminary treatment of various types of ore will here be carried out by students on a scale approaching commercial practice.

A summer school of mining is held each year immediately following the close of school in June. A suitable mining locality having been selected, students under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Junior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a whole-

some regard for the efforts of the department and constitutes one of its most valued assets.

The following courses are offered by the department:

Mining 1-3.

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Four lecture periods and three laboratory hours per week.

Mining 2-4.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year, Second Semester: Three lecture periods per week for eight weeks.

The field work of this course occupies one week of the summer school in June, between the Sophomore and Junior years, and with the subsequent calculation and plotting of notes here obtained, completes the course.

Mining 5.

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn

drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters; steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Junior Year, First Semester: Three lecture periods per week.

Mining 6.

Tunneling: The driving of mine tunnels and drifts through rock and through soft or running ground; comparative costs; general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft Sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Junior Year, Second Semester: Three lecture periods per week.

Mining 7.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive powers; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tram ways and aerial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 8.

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Senior Year, Second Semester: Two lecture periods per week.

Mining 9.

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames; pneumatic hoisting; costs.

Senior Year, First Semester: Three lecture periods per week. Mining Engineering Option.

Mining 10.

Ventilation: Natural and induced ventilation; fur-

naces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer Mining: Sluices, riffles, pipe lines, nozzles and hydaulic elevators, their construction and use; river dredging; costs and results.

Mine Examination: Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties; forms of report.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 11-12.

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 13.

MR. C. L. LEWIS

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs,

rules and regulations of miners; lands subject to location and who can locate; the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, First Semester: One lecture period per week for twelve weeks.

Mining 14.

PROFESSOR EHLE

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Senior Year, Second Semester: Two lecture periods per week.

Department of Engineering

Professor Steele

The aim of this department is to give the student such training in the class room, drawing room and field as will properly fit him for his career as a mining engineer.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size; lecture room and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Engineering 1-2.

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometic and cabinet projections, machine details, and both free hand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair of 6-in. Compasses, with pen, pencil and needle points.
One pair 6-in. Dividers.
One 5½-in. Ruling Pen.
One 3½-in. Steel Spring Bow Divider.
One 3½-in. Steel Spring Bow Pencil.
One 3½-in. Steel Spring Bow Pen.
One T Square with 30-in. blade.

One 4½-in. Protractor.
Two Irregular Curves.
One 7-in. 30° by 60° Triangle.
One 8-in. 45° Triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

Anthony's Mechanical Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Engineering 3-4.

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Engineering 5-6.

Surveying: It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make

his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, geodetic surveying, including the measurement of a base line; measurement of the horizontal angles; computation for the adjustment of the triangulation system; determination of the meridian by means of the solar instrument; determination of latitude; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Sophomore Year, First Semester: Three lecture periods and three hours field work per week; second semester, three lecture periods per week for eight weeks and three hours field work per week for the whole semester.

A three weeks' summer school for practical work immediately follows the close of school in June, and completes the course in surveying. Two weeks are devoted to general surveying and one week to mining surveying under the Department of Mining.

Text Book: Johnson's The Theory and Practice of Surveying.

Engineering 7.

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Engineering 5-6.

Junior Year: Three laboratory hours per week for eight weeks.

Engineering 9.

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. The application to mining machinery is always kept in mind. Drafting room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week.

Engineering 11-12.

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amount of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: One lecture period and three laboratory hours for eight weeks of the first semester and all of the second semester.

Text Book: Hoskins, Elements of Graphic Statics.

Engineering 14.

Strength of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel, and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Engineering 15.

PROFESSOR VAN NUYS

Electricial Engineering: This course deals with the principles and general construction of dynamo-electric machinery; systems of direct current distribution; direct current motors, their action, control and application; lighting equipments; the design; installation and operation of electric power plants, the principles and general construction of alternating and polyphase dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments, in the operation and testing of direct and alternating current generators, motors, and transformers, in electrical measurements, and photometry of electric lamps.

Senior Year, First Semester: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Franklin & Esty, Elements of Electrical Engineering, 2 Vols.

Engineering 16.

PROFESSOR VAN NUYS

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Senior Year, Second Semester: Four lecture periods per week for eight weeks.

Engineering 18.

PROFESSOR VAN NUYS

Hydraulics: The student takes up this course with

a knowledge of hydrostatics from his work in Physics 5, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water. He learns the methods of commercial measurement of water by both weir and orifices. The problems include the computation of diameters of pipes; pressure and energy of confined water; dimensions of channels and ditches; velocity of flow, etc.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for weir and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Four lecture periods and three laboratory hours per week for eight weeks.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Engineering 20.

PROFESSOR STEELE

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels.

The school has three boilers aggregating 250 horsepower, and a 40-horse-power Corliss engine; also a gasoline and a kerosene engine. This apparatus is available for laboratory work in this course.

Senior Year, Second Semester: Two lecture periods per week for the semester and three laboratory hours per week for eight weeks.

Department of Physics

Professor Van Nuys

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

Especial attention is given to the general laws underlying the science, and the history of the discovery and development of the important results is considered carefully. In the laboratory courses, the purpose is to excite in the student an interest in experimentation and to develop the ability for careful observation and the testing and sifting of results.

The courses offered by the department are as follows:

Physics 5.

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 9. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics. The complete treatment of the latter here serves as an introduction to the study of Hydraulics in the Senior year.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics in the Senior year.

Junior Year, First Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 6.

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, potential, elec-

tromagnetism, and electromagnetic induction are studied in detail, and a comprehensive consideration of electrical measuring instruments, dynamos, and motors, is entered into. The course closes with a development of the laws of alternating currents and a study of alternating current machinery and transformers. This course is a necessary preparation for the course in electrical engineering in the Senior year.

The subject of light is considered from the standpoint of the electro-magnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction, and polarization and of the theory of optical measurements.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 7.

Laboratory course to accompany Physics 5. The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity of solids, liquids and gases, acceleration of gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of calorific power of fuels, specific and latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves.

Junior Year, First Semester: Three laboratory hours per week.

Physics 8.

Laboratory course to accompany Physics 6: The laboratory is well equipped for an extensive course in electrical testing. The apparatus includes a complete

set of Weston meters, including voltmeters, millivoltmeters, ammeters, millameters, alternating current voltmeters, and ammeters, electro-dynamometers, fluxmeters, magnetometers, potentiometers, permeameters, voltameters, Wheatstone bridges, many types of galvanometers, condensers, induction coils, static machines, Tesla transformers, X-Ray tubes, wireless telegraph, etc. Dynamos, motors and electric lamps of various types, are at hand for the purpose of making tests of commercial efficiency.

The equipment for optical measurements is ample and includes optical benches for refraction, interference, diffraction, polarization, for use with projection apparatus, spectroscopes, spectrometers, polariscopes, heliostats, photometers, etc.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Junior Year, Second Semester: Six laboratory hours per week.

Physics 9.

Analytic Mechanics: The theory is developed by lectures. Many problems will be solved to enforce the principles and to develop ability in the student to apply what he has learned to practical problems. Particular effort is made to cultivate the power of the student to use calculus methods when needed. The course includes the following subjects:

Statics: First principles; units, composition and resolution of concurring forces; composition and resolution of forces acting on a rigid body; conditions of equilibrium; center of gravity; friction; virtual velocities; machines; the funicular polygon and the catenary.

Kinematics: Rectilinear and curvilinear motion; composition and resolution of acceleration; angular velocity and angular acceleration; projectiles, etc.

Kinetics: Laws of motion; motion under the action of a variable force; motion in a resisting medium;

constrained motion; the simple pendulum; centripetal and centrifugal forces. Impact; work and energy; moment of inertia.

Junior Year, First Semester: Four lecture periods per week.

Text Book: Bowser's Analytic Mechanics; the works of Church, DuBois, Hoskins, Johnson, Lanza, Todhunter, and Routh, are used for reference.

Department of Chemistry

PROFESSOR COOLBAUGH

The courses in chemistry are designed to give to mining and to metallurgical engineers the knowledge of chemistry most essential to their work. Especial emphasis is given to the laws underlying the science; the separations, estimations, etc., being made with these principles in mind. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation, and to teach the proper correlation of the results of experiments.

Chemistry 5-6.

General Chemistry: Lectures. This course is designed to give to the student a knowledge of the principal theories and laws of the science. The following subjects are discussed in an elementary way: Atoms and molecules, gases, liquids, solids, solutions, thermo- and electro-chemistry, and chemical equilibrium. Special attention is given to those portions of the subject bearing upon osmotic pressure, freezing and boiling points of solutions, electrolytic dissociation and the law of mass action. A small amount of time is also given to the consideration of organic chemistry.

Freshman Year: Three lecture periods per week throughout the year.

Reference Books: Newth's Inorganic Chemistry; Ostwald's Principles of Inorganic Chemistry; Jones' Elements of Physical Chemistry.

Chemistry 8.

General Chemistry Laboratory: Inorganic preparations, the study of crystallization and distillation, the use of indicators, and the effect of mass upon the time and extent of reactions.

Freshman Year: Three laboratory periods per week for the second half year.

Chemistry 9-10.

Qualitative Analysis: Lectures. The work in qualitative analysis begins with an outline of the general scheme of analysis. Then follows a minute study of the metals and the acids radicals with their detections and separations. Emphasis is placed on the principles of oxidation and reduction, and the theories of ionization and hydrolysis. Separations are made before the class in order to give an idea of the correct use of reagents and of the methods for rapid manipulation.

Freshman Year, First Semester: Two lecture periods per week; second semester, one lecture per week.

Reference Books: Prescott & Johnson's Qualitative Analysis; Treadwell's Qualitative Analysis.

Chemistry 11-12.

Qualitative Analysis: Laboratory. This covers the separation of metals and acids in solutions, dry mixtures, minerals, slags and alloys.

Freshman Year, First Semester: Nine laboratory hours per week; second semester, six laboratory hours per week.

Chemistry 13-14.

Industrial Chemistry: Lectures. The subjects considered in this course are acids, alkalis, sulphur, chlorine, bromine, iodine, cyanides, fertilizers, explosives, bricks, clays, cements, mineral paints, fuel and refractory materials.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Book: Thorp's Outlines of Industrial Chemistry.

Chemistry 15-16.

Quantitative Analysis: Lectures. The work in quantitative analysis consists of discussions of the relative merits of methods applied in the laboratory,

the study of articles and reviews from chemical periodicals, and the subject of chemical calculations.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Books: Miller's Quantitative Analysis; Miller's Calculations of Analytical Chemistry; Treadwell's Quantitative Analysis; Sutton's Volumetric Analysis; Low's Technical Methods of Ore Analysis.

Chemistry 17-18.

Quantitative Analysis: Laboratory. The course covers the subject of mineral analysis, including both gravimetric and volumetric methods. The analyses required are: Magnesium sulphate, sodium or other chloride, potassium alum, coal, iron ammonium alum, iron ore, pig iron, spiegel or manganese ore, zinc ore, copper ore or matte, brass, lead ore, chromic iron, limestone, arsenic ore, antimony ore, slag, and gas analysis.

Sophomore Year: Nine laboratory hours per week throughout the year.

Chemistry 19-20.

Metallurgical Chemistry: Lectures. This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. The subjects studied are: The technical methods connected with the metallurgy of iron, steel, zinc, lead and copper; the determinations of bismuth, mercury, cadmium, tin, nickel, and the rare elements of commercial importance, and the analysis of electrolytic slimes.

Prerequisites: Chemistry 2, 3 and 4, or equivalents.

Junior Year, First Semester: Three lecture periods per week; second semester, one lecture period per week. Required of Juniors taking the metallurgical option.

Chemistry 21-22.

Quantitative Analysis: Laboratory. Work corresponding to Chemistry 19-20.

Junior Year, First Semester: Six hours per week; second semester, two hours per week.

Department of Metallurgy

Assistant Professor German

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated, in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products, and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 2.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussion of metallurgical principles; slags and furnace products, and their nature; types of furnaces and furnace construction; the means of supplying and heating blast; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes, and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room, and hand in for examination, papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior year, and is described under Metallurgy 19.

Sophomore Year, Mining Engineering option, Second Semester: Three lecture hours per week.

Text Book: Fulton, Principles of Metallurgy.

Metallurgy 4.

Introductory Metallurgy: Same course as Metallurgy 2, but amplified by detail.

Sophomore Year, Metallurgical option, Second Semester: Five hours per week.

Text Book: Fulton, Principles of Metallurgy.

Metallurgy 5.

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up , first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is taken up in detail; the general mill arrangements; clean up; the influences of other pro-

cesses following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is taken up. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation and the proper performance of laboratory experiments is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior year, both options, First Semester: Three hours per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; MacFarren, Cyanide Practice.

Metallurgy 6.

The Metallurgy of Gold and Silver: This course comprises lectures on the cyanidation of silver ores; the melting and refining of gold and silver bullion; the parting of gold from silver; detailed discussion of the roasting of gold and silver ores, preliminary to extraction processes; the chlorination process; details of gold milling processes not taken up in course 5.

Senior Year, Metallurgical Option, Second Semester: Three hours per week.

Text Book: Julian & Smart, Cyaniding of Gold and Silver Ores.

Metallurgy 7.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and

steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, First Semester: Two hours per week. Lecture notes.

Metallurgy 8.

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up; also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining Option, Second Semester: Two hours per week.

Text Book: Austin, Metallurgy of the Common Metals. Reference works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting;

Iles, Lead Smelting; Schnables, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 10.

The Metallurgy of Copper and Lead: The same as Metallurgy 8, except that it is amplified by detail.

Senior Year, Metallurgical Option, Second Semester: Five hours per week.

Metallurgy 11.

Metallography: The study of metals and alloys by the microscope. The preparation of microsections. Thermal analysis. The study of iron, steel, brasses, bronzes, bearing metals, etc. Micro-photography.

Senior Year, Metallurgical Option, First Semester: One hour per week lectures, three hours per week laboratory work.

Text Book: Desch, Metallography.

Metallurgy 13.

Electro-metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, silver, lead, nickel and tin.

Electrothermic processes. Theory. The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc and for miscellaneous purposes.

Senior Year, Metallurgical Option, First Semester: Two hours per week.

No text book required. Reference works: Stansfield, The Electric Furnace; Borches, Electric Smelting and Refining.

Metallurgy 15.

The Metallurgy of Zinc, and the Minor Metals: The roasting of zinc ores; zinc distillation furnaces; the distillation process, the purification of spelter; commercial considerations. The metallurgy of nickel, antimony, tin, bismuth, tungsten and arsenic.

Senior Year, Metallurgical Option, First Semester: Two hours per week.

No text book required. Reference work: Ingalls, The Metallurgy of Zinc and Cadmium; Schnabel, Handbook of Metallurgy, Vol. II.

Metallurgy 17-18.

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, motar box and block, 5-stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Six laboratory hours per week for the first semester and three laboratory hours per week for the second semester.

Metallurgy 19.

Metallurgical Laboratory: Laboratory practice in pyrometry; the calibration of the thermo couple; the roasting of ores, noting the formation of sulphates, etc., the desilverization of lead bullion by means of zinc; the electrolytic deposition of copper and lead; the roasting of gold and silver ores; experiments with the cyanide process, including the titration of pure and mill solutions with silver nitrate, analysis of cyanide solutions, cyanide experiments with small lots of ore in the laboratory to determine extraction, etc.

Senior Year, Mining Engineering Option, First Semester: Three laboratory hours per week.

Text Book: Clennel, Chemistry of Cyanide Solutions; and Howe, Laboratory Note Book.

Metallurgy 20.

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 21-22.

Metallurgical Laboratory: Course similar to Metallurgy 19, but amplified.

Senior Year, Metallurgical Option: Six laboratory hours per week throughout the year.

Metallurgy 24.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents; the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and the excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloys for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Fulton, Manual of Fire Assaying.

Department of Mathematics

PROFESSOR MCLAURY

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

No course in Algebra is offered in the Engineering Department. However, in the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. Students who are not well grounded in algebra will be expected to take Mathematics 6, Algebra C with their freshman work.

Mathematics 7.

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8.

Analytic Geometry: This course includes the following subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry, with Smith & Gale, Puckle, Ashton and C. Smith for reference.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include the discussion of a few subjects in higher algebra and will be preceeded by a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Snyder & Hutchinson, Murray, and Williamson are used for reference.

Mathematics 10.

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Department of English

PROFESSOR MCLEARIE

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Especial emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Wendell's English Composition; Pearson's Principles of Expression; Baldwin's College Manual of Rhetoric.

English 10.

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Economics.

This course will give a brief survey of the principles of economics. It will also include discussions of the

more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

List of Students, 1912-13

Graduate Student.

Quinney, Elwin H., B. S., 1911....Alexandria, S. D.

Senior Class.

Alder, Alfred, Jr. .....Volin, S. D.
Anderson, Amil A. .....Rapid City, S. D.
Hartgering, J. M. .....Rapid City, S. D.
Henton, Hugh M. .....Spearfish, S. D.

Junior Class.

Bochert, W. C. .....St. Augustine, Florida
Eldredge, Robert B.....Colorado Springs, Colorado
Fahrenwald, Arthur W. .....Rapid City, S. D.
Farnham, Lloyd L. .....Sioux City, Iowa
Fleischman, Leo .....New York, N. Y.
Hill, Robert S. .....Rapid City, S. D.
Holly, George .....Rapid City, S. D.
McCauley, Willard J. .....Aberdeen, S. D.
Pryer, W. Cristy .....Aberdeen, S. D.
Stowell, George E. .....Perry, Michigan
Thiel, Arthur .....Alexandria, S. D.

Sophomore Class.

Booth, Lionel E. .....Virginia, Minnesota
Borst, O. H. .....Pierre, S. D.
Dennis, Paul .....Hot Springs, S. D.
Gates, Clyde .....Rapid, City, S. D.
Johnson, J. Harlan .....Philadelphia, Penna.
Johnson, Raymond .....Rapid City, S. D.
O'Harra, B. Marvel .....Rapid City, S. D.
Peck, George C. .....Henry, S. D.
Richardson, George A. .....Cannon Falls, Minnesota
Wheelock, Clarence E. .....Rapid City, S. D.

Freshman Class.

Brainard, Harry D. ..... Rapid City, S. D.
Byrne, Francis J. ..... Faulkton, S. D.
Cassilly, Tom. ..... St. Paul, Minnesota
Cragin, Rodney ..... Arpan, S. D.
Gallaher, Raymond ..... Rapid City, S. D.
Hill, Joseph ..... Rapid City, S. D.
Humbert, Glenn ..... Spearfish, S. D.
Mathieson, C. E. ..... Fort Pierre, S. D.
McElroy, Jack ..... Rapid City, S. D.
Nicholas, Thomas A. ..... Spearfish, S. D.
Rugg, Harold H. ..... Rapid City, S. D.
Smith, Elwyn ..... Rapid City, S. D.
Snyder, William E. ..... Onida, S. D.
Thomas, Lorin ..... Rapid City, S. D.
Wilmarth, J. B. ..... Aberdeen, S. D.

Special Students.

Ankerman, Ida M. ..... Rapid City, S. D.
Hooper, William J. ..... Virginia, Minnesota
Isbell, Jessie ..... Rapid City, S. D.
Sherman, Frank ..... Pactola, S. D.
Van Nuys, Laura ..... Rapid City, S. D.

Preparatory Students.

Alder, Herbert ..... Volin, S. D.
Appel, Fane ..... Rapid City, S. D.
Brown, George ..... Rapid City, S. D.
Brown, James ..... Rapid City, S. D.
Burke, Timon ..... Rapid City, S. D.
Crittenden, Donald ..... Rapid City, S. D.
Curtis, Willard ..... Rapid City, S. D.
Gates, Edgar ..... Rapid City, S. D.
Griffin, Arthur ..... Selby, S. D.
Griffin, Elton ..... Selby, S. D.
Holly, Maurice ..... Rapid City, S. D.
Hoyt, Myron ..... Box Elder, S. D.
Layman, Dale ..... Rapid City, S. D.
Lee, Gladys ..... Rapid City, S. D.

Lee, Myrtle ..... Rapid City, S. D.
Lynch, Maurice ..... Rapid City, S. D.
McCain, Galen ..... Rapid City, S. D.
Morrison, Edgar ..... Rapid City, S. D.
Nelson, Oliver E. ..... Rapid City, S. D.
Platt, Edward ..... Rapid City, S. D.
Potter, L. A. ..... Groton, S. D.
Price, Virgil T. ..... Rapid City, S. D.
Raybourne, Earl ..... Rapid City, S. D.
Ronne, A. E. ..... Rapid City, S. D.
Royse, Joseph B. ..... Rapid City, S. D.
Spayde, Kenneth ..... Rapid City, S. D.
Sweeney, Peter ..... Rapid City, S. D.
Sweeney, Thomas ..... Rapid City, S. D.
Thickston, A. J. ..... Rapid City, S. D.
Wentworth, Henry ..... Rapid City, S. D.
Wheelock, George ..... Rapid City, S. D.

Alumni

Eighteen Hundred Eighty-Eight.

John W. Hancher, B. S., M. S., South Dakota School of Mines; LLD., Simpson College; 150 Fifth Avenue, New York, N. Y.

Eighteen Hundred Ninety.

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S. Western Representative Gerhard-Mennen Chemical Co., Newark, N. J.

Eva Robinson, B. S., M. A. Supervisor of the Domestic Science Department, University of Chicago, Chicago, Ill.

Eighteen Hundred Ninety-One.

Mrs. Otillie Behrens Alger, B. S., Hermosa, S. D.

Nineteen Hundred One.

G. Howell Clevenger, B. S., E. M., South Dakota School of Mines; M. A., Columbia University; Associate Professor of Metallurgy, Stanford University, California.

Max Hopkins, B. S. With International Correspondence School of Scranton, Pa. Address, 1415 Majestic Building, Milwaukee, Wis.

Nineteen Hundred Two.

Areli C. Overpeck, B. S., E. M. Superintendent Dakota-Calumet Mining Co., Hill City, S. D.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four.

U. S. S. Arentz, B. S., E. M. General Superintendent Nevada Douglas Copper Co., and Nevada Copper Belt R. R., Ludwig, Nev.

Arthur E. Hall, B. S., Met. E. Assistant Superintendent, Copper Department, American Smelting & Refining Co., Omaha, Nebr.

Elmer W. West, B. S., M. E. Engineer, Nevada-Omaha Mining and Milling Co., Bannock, Nev.

Guy E. Wolcott, B. S. Mining Engineer, Golita, Calif.

Nineteen Hundred Five.

O. Allen Anderson, B. S., E. M. Mill Superintendent Whitcomb, Mont.

James Halley, Jr., B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Engineer, Oliver Iron Mining Co., Virginia, Minn.

Nineteen Hundred Six.

Louis L. Penhoel, B. S. Superintendent, Dexter Mining and Development Co., Atlantic City, Wyo.

Peter Whytock, B. S. Mining Engineer, National, Nevada.

William Gains, B. S. Mill Foreman, Yellow Jacket Mining Co., Salmon City, Idaho.

B. D. O'Brien, E. E., Rose Polytechnic, 1896; B. S., E. M., South Dakota School of Mines. With Golden Reward Mining Co., Deadwood, S. D.

Frederick Witherald, B. S., Boston, Mass.

Earl Van L. Smith, B. S., Akron, Ohio.

Edwin Coolidge, B. S., E. M. Mill Superintendent, Cumberland Mining Co., Maiden, Mont.

Herbert Seiter, B. S. Mining Engineer, Omaha, Neb.

Harry T. Curran, B. S., E. M. With St. Louis Mining Co., Marysville, Mont.

J. Burns Read, B. S., E. M. Assistant Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Nineteen Hundred Seven.

Frank Bryant, B. S., E. M. Cumberland Mining Co., Maiden, Mont.

Frank Anderson, B. S. Engineer, Portland, Oregon. 204 1-2 Washington St., care of Wells and Co.

Wharton Cornell, B. S., 1711 Rodney St., Wilmington, Del.

Otto Ellerman, B. S., E. M. State Mine Inspector, Sturgis, S. D.

Bernard Matson, B. S., U. S. Assay Office, Deadwood, S. D.

Lloyd Mellinger, B. S. Assayer and Chemist, Mountain Copper Co., Martinez, Calif.

Milton Morris, B. S., Rapid City, S. D.

C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M., Columbia University. Professor of Physics, South Dakota School of Mines, Rapid City, S. D.

Charles Whitmore, B. S. Cashier Lincoln County Bank, Canton, S. D.

Leon Peck Wells, B. S. Engineer, Calumet and Arizona Mining Co., Box 1433, Bisbee, Ariz.

Nineteen Hundred Eight.

Cyril Cooledge, B. S. With Rosario Mining Co., San Juancito, Honduras, C. A.

L. L. Hebblethwaite, B. S., Rapid City, S. D.

Glen P. Ives, B. S. Mining Engineer, Box 962, Santiago, Chile.

Lem S. Overpeck, B. S. Assistant Engineer, Amalgamated Copper Co., Anaconda, Mont.

D. C. Woodard, B. S. Assayer and Metallurgist, Cassila 962, Santiago, Chile.
Fred W. Winters, B. S., E. M. With Spotted Horse Leasing Co., Maiden, Mont.
W. G. Sparling, B. S., Rapid City, S. D.
Ignacio Diaz Ossa., B. S. Assayer and Metallurgist, Cassilla, 962, Santiago, Chile.
Ivan E. Goodner, B. S. Cyanide Chemist, Alaska-Treadwell Gold Mining Co., Treadwell, Alaska.

Nineteen Hundred Nine.

Jesse O. Betterton, B. S. Assistant Chemist, American Smelting and Refining Co., Omaha, Neb.
Roy F. Coolidge, B. S., E. M. Mill Superintendent, Kendall Gold Mining Co., Kendall. Mont.
Eli A. Hvistendahl, A. B., University of South Dakota; B. S., South Dakota School of Mines. With American Smelting and Refining Co., Omaha, Neb.
H. W. Jones, A. B., University of South Dakota; B. S., South Dakota School of Mines. Science Department, Jamestown High School, Jamestown, N. D.
Lewis W. Ledyard, B. S. Draftsman, Homestake Mining Co., Lead, S. D.
Willard C. Marshall, B. S. With Rapid City Pressed Brick Co., Rapid City, S. D.
Herbert N. Read, B. S., E. M. With Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Ten.

Richard T. Bennett, B. S. United States Deputy Mineral Surveyor, Pierre, S. D.
John Wasson Eddy, B. S. Surveyor with C. M. & St. P. R. R., Stanford, Mont.
John Wing Elliott, B. S., Columbus, Nebr.
George Earl Flower, B. S. With Goodyear Tire and Tube Co., Akron, Ohio.
Zay Jeffries, B. S. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Arthur E. Sargeant, B. S. Assayer, Lundberg, Dorr & Wilson, Terry, S. D.
John William Stoner, B. S. City Auditor, Lead, S. D.
Joseph H. Saville, B. S. Chemist, Washoe Smelter, Anaconda, Mont.
Harry Ellis Wheelock, B. S. Mine Surveyor, Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Eleven.

William L. Anderson, B. S. Mining Engineer, Leesburg, Idaho.
Floyd Brooks, B. S. With Inspiration Copper Co., Miami, Arizona.
Chester G. Ehle, B. S. Municipal Engineering Dept., Portland, Oregon.
Fred J. Muhmel, B. S., Scotland, S. D.
Elwin H. Quinney, B. S. With State Engineer, Pierre, S. D.
Frank H. Winsor, B. S. Chemist with Mason Valley Mines, Thompson, Nevada.
Clarence G. Willard, B. S. With Golden Reward Mining Co., Deadwood, S. D.

Nineteen Hundred Twelve.

Samuel C. Dickey, B. S. Aassayer with Bismark Mine, Flatiron, via Lead, S. D.
Frank A. Fahrenwald, B. S. Instructor in Metallurgy, Pennsylvania State College, State College, Pa.
Peter Mosier, B. S. Rapid City, S. D.

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South Dakota State School of Mines

Annual Catalog 1913-1914

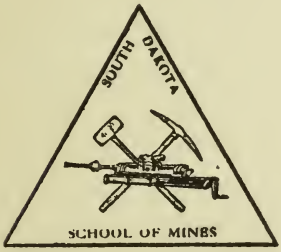
With Announcements for 1914-1915

Rapid City, South Dakota

May 1914

South Dakota State School of Mines

Annual Catalog 1913-1914



With Announcements for 1914-1915

Rapid City, South Dakota

May 1914

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SOUTH DAKOTA STATE SCHOOL OF MINES, RAPID CITY, S. D.

College Calendar

1914

Registration Committee Considers applications for advanced standing and credentials for admission ..... September 15
School Year begins .... Wednesday, September 16
Thanksgiving Recess..November 26 to 28 inclusive
Christmas Vacation begins ..... December 21

1915

Christmas Vacation ends ..... January 2
Short Course Begins ..... January 4
Midyear Examinations .. January 25 to 30 inclusive
First Semester ends ..... January 30
Second Semester begins ..... February 1
Short Course ends ..... February 13
Washington's Birthday ..... February 22
Annual Field Trips ..... April 5 to April 12
Baccalaureate Sermon ..... May 23
Final Examinations ..... May 24 to 29 inclusive
Faculty Reception ..... May 25
Commencement and Conferring of Degrees, May 26

Regents of Education

Members of the Board

THEODORE W. DWIGHT, Sioux Falls,
Term Expires January 1, 1915.
A. E. HITCHCOCK, Mitchell
Term Expires January 1, 1915.
ALBERT M. ANDERSON, Sturgis.
Term Expires January 1, 1917.
M. P. BEEBE,* Ipswich
Term Expires January 1,1919.
AUGUST FRIEBERG, Beresford.
Term Expires January 1,1919.

*Frank Anderson, Webster, appointed in April, 1914 to fill the unexpired term of M. P. Beebe, deceased.

Officers of the Board

A. E. MITCHCOCK, President, Mitchell.
FRED FORD, Secretary, Elk Point.
A. W. EWERT, (State Treasurer),
Treasurer Ex-officio.

Regents Committee in Charge of the School of Mines.

A. M. ANDERSON A. E. HITCHCOCK

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology.
A. B., Carthage College; Ph. D., Johns Hopkins University.

MELVILLE FULLER COOLBAUGH
Vice President and Professor of Chemistry.
B. S., Colorado College; A. M., Columbia University.

HOWARD LINCOLN McLAURY
Professor of Mathematics.
A. B., Oberlin College; A. M., Harvard University.

MARK EHLE
Professor of Mining.
E. M., Colorado School of Mines.

CLAUDE CORNELIUS VAN NUYS
Professor of Physics.
A. B., Yankton College; B. S., E. M., South Dakota State School of Mines; A. M., Columbia University.

JOSEPH HERBERT STEELE
Professor of Engineering.
B. S., C. E., Michigan Agricultural College.

JOHN McLEARIE
Professor of English.
A. B., Macalester College; A. M., University of Chicago.

CLARENCE LESLIE LEWIS
Lecturer on Mining Law.
University of Michigan.

VICTOR ZIEGLER
Professor of Mineralogy and Petrography.
A. B., University of Iowa; A. M., Columbia University.

WELTON JOSEPH CROOK
Professor of Metallurgy.
Melbourne School of Mines; A. B., Leland Stanford University.

HUGH W. TALBOT
Instructor in Preparatory Science and Mathematics.
B. S., Colgate University.

E. ESTELLE CARRIER
Instructor in Modern Languages and History.
Ph. B., Cornell College.

WILLIAM A. COURSEN
Superintendent of Buildings and Grounds and Instructor in Machine Shop.

DELLA MAY HAFT
Librarian
Ph. B., University of Chicago.

BERTHA MORRIS
Registrar and Secretary to the President.

Other Employees

W. C. BOCHERT, Student Assistant in Metallurgy.
ROBERT S. HILL, Student Assistant in Physics.
W. C. PRYER, Student Assistant in Chemistry.
ARTHUR THIEL, Student Assistant in Chemistry.
MRS. A. O. ANDERSON, Janitor.
FRANK BOYD, Fireman.

Standing Committees of the Faculty

Committee on Admission and RegistrationA:

PROFESSOR EHLE, Chairman.
PROFESSOR STEELE
PROFESSOR VAN NUYS
MR. TALBOT

Committee of Theses and Degrees:
PROFESSOR CROOK, Chairman
PROFESSOR COOLBAUGH
PROFESSOR McLAURY
PROFESSOR ZIEGLER
PROFESSOR EHLE

Committee on Emergencies:
PROFESSOR COOLBAUGH, Chairman
PROFESSOR EHLE
PROFESSOR McLAURY
PROFESSOR McLEARIE
PROFESSOR STEELE
PROFESSOR VAN NUYS

Committee on Athletics:
PROFESSOR ZIEGLER, Chairman
PROFESSOR McLEARIE
PROFESSO EHLE
PROFESSOR CROOK

Committee on School Magazine:
PROFESSOR McLEARIE, Chairman
PROFESSOR ZIEGLER
PROFESSOR CROOK

Committee on Catalog:
PROFESSOR STEELE, Chairman
MR. TALBOT

Committee on Library:
PROFESSOR COOLBAUGH, Chairman
PROFESSOR VAN NUYS
MR. TALBOT
MISS HAFT

Committee on Student Welfare:
PROFESSOR McLAURY, Chairman
PROFESSOR VAN NUYS
MR. TALBOT

Board of Control of the Athletic Association:
PROFESSOR EHLE, Chairman
MR. W. C. BOCHERT, Secretary
PROFESSOR McLEARIE
PRESIDENT O'HARRA
MR. GEORGE HOLLY
MR. RODNEY CRAGIN
DR. G. C. REDFIELD

PROFESSOR McLAURY, Secretary of the Faculty.

J. H. WINTERRINGER, Football Coach

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 p. m.

RAPID CITY, LOOKING NORTHWEST

THE
JOHN CRERAR
LIBRARY

General Statement

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part by the state as state institutions.

The following is an extract from the act of the legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special intruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible, the school also aids the development of the miner-

al resources of the state by the investigation of mining and metallurgical problems which arise. At the present time, many graduates of the School are employed in responsible positions in the Black Hills and throughout the West generally, and are doing much toward the development of the state's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting and to cyanidation.

Recent demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this school, together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. These may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratory, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school, however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that purpose. In 1903 $18,000 was appropriated by the legislature for a rear addition, and $5,000 was appropriated for the construction

of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the Preparatory Building, $2,500 for replacements in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment, at the present time, is such as to give good facilities for thorough instruction in mining and metallurgy, and allied subjects.

Location

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of an equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit with its particular and sometimes striking color yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse,

bare granite rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately somber forms of porphyry buttes, there is presented a view well worth many hardships to see.

The climatic Conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock-raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The total mineral production since the first mining in 1875 is approximately $190,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in

the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 4,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid Creek 3200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere

to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and bustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but, to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses

The School of Mines has from the early days of its organization maintained classes in various branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give extended courses in these subjects. Last year the Regents of Education authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In con-

formity with this authorization a four years course in Electrical Engineering and a four years course in Civil Engineering have been outlined and the first two years of each of these courses will be offered during the coming year. In the purchase of apparatus for teaching these engineering courses, efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In civil engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In electrical engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Four hydro electric plants on as many different mountain streams of the Black Hills and costing approximately two million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which students found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and

a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and the Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Engineering. The chemical laboratories comprise the general, qualitative, and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The Department of Engineering consists of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop. The machine shop enables the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories high, built of red brick covered with stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy. It con-

RELIEF MAP OF THE BLACK HILLS

THE
JOHN CRERAR
LIBRARY

tains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horsepower of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

Equipment

In general, the school is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

Library

The library and reading room occupies a large, well lighted and well equipped room on the first floor of the Main building. Here are found the standard works on Metallurgy, Mining, Geology,

Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Economics, and many works of a general nature.

Authoritative scientific journals published in the United States, Canada, Mexico, England and Germany are found on the reading tables and are bound when volumes are completed—putting in substantial form the latest research in the sciences taught in this school. Some of these sets are complete, such as the *American Journal of Science,* consisting of one hundred eighty-two volumes; *Journal of Geology,* nineteen volumes; *Journal of Society of Chemical Industry,* thirty volumes. Others, such as *Engineering and Mining Journal, Mining and Scientific Press, Mines and Minerals,* are nearly complete and are being completed as rapidly as possible.

The publications of the learned societies of the United States and England are represented by Proceedings of the Royal Society of London, of the Institution of Mining and Metallurgy, of the Institution of Mining Engineers, of the Iron and Steel Institute and of the American Institute of Mining Engineers.

The library is the repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

A library of four hundred volumes has been loaned to the school by the Rapid City Library Association. This collection contains works on literature, history and science.

The Dewey system of classification is used and a card index gives author, title and subject.

The privileges of the Library are extended to those not attending the college who may find use for its books of reference.

Drawing Rooms

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. The drawing rooms are well lighted by many windows. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories

There are three chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, and one for quantitative analysis. The last two laboratoies are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate balance room in which are analytical balances of standard makes, among them Becker's and Troemner's. There is also a private laboratory for the professor of Chemistry.

The apparatus is ample for all mineral, alloy and rock analysis, and includes combustion furnaces, apparatus for gas analysis, facilities for electrolytic precipitations, calorimeters for fuel analysis and spectroscopes for qualitative experiments.

Biological Laboratory.

In the Biological Laboratory many new pieces of apparatus have recently been added to the equipment. Among them is a large Alberene stone aquarium with plate glass sides in which are kept aquatic plants and animals for the study of their interrelations and their habits of growth and reproduction. Small balanced aquaria are also maintained for this purpose. The equipment is modern, including compound microscopes with accessories, sterilizers, a triple-walled incubator, charts, and adequate apparatus for technique. The museum collection is suitable for botanical and zoological purposes.

Physical Laboratory.

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, reciprocating and mercury air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity; Steinhall spectroscope, large vernier spectrometer; complete apparatus for measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for calorimetric determinations of specific heat, heat of combustion, heat of vaporization, etc.; Dalton's apparatus; complete apparatus for the determination of the mechanical equivalent of heat; seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters, wattmeters, Leeds and Nor-

thrup potentiometer, wheatstone bridges, condensers, electro-dynamometers, hot wire meters, Weston and Cambridge Scientific Company galvanometers, electrometers, magnetometers, voltameters, fluxmeters, permeameters, and Woulff precision resistances and Leeds and Northrup variable inductance; also completely equipped switchboards for both high and low voltage distribution of alternating and direct current, made by Max Kohl of Germany; and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; motor generator set, and a variety of dynamos and motors, gasoline engines, induction machines, and models of steam and gas engines.

In addition to the above, the school heating and lighting plant, and the equipment of the Departments of Mining and Metallurgy afford the student opportunity of making tests on dynamos and motors, engines and turbines of commercial sizes.

The school also possesses a completely equipped wireless telegraph station, consisting of a sending set of 1 K. W. capacity and a sensitive receiving set for long distance messages. The laboratory is well equipped with tools and work benches for the construction of special apparatus.

New Electrical Apparatus.

Some important additions to the equipment of the Department of Physics and Electrical Engineering have been made during the year. Among these is a Rotary Converter designed for many different kinds of experimental work. This machine was manufactured by the Westinghouse Electric and Manufacturing Company and embodies in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or a motor. When using alternating

current its operation may be one, two or three phase. Complete switchboard equipment for its control in any one of its many modes of operation is provided, including a complete set of high grade measuring instruments for both alternating and direct current measurements. These include Ammeters, voltmeters, wattmeters, power factor meter, frequency meter and dial synchroscope, all mounted upon while marble panels. This equipment enables the student to make actual working tests upon a number of the various forms of dynamos and to become acquainted with their actual operation and control.

During the year there have also been added a number of important pieces of apparatus for measurements in Electro-statics, light and radio-activity. These include sensitive electrometers and electroscope, as well as some delicate optical apparatus.

Apparatus for Civil Engineering

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, one Gurley transit with solar attachment, one Keuffel and Esser transit with Saegmuller attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, seven levelling rods, together with complete equipments of stadia rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory.

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fire-proof. There is a melting furnace using coke, and gasoline furnaces made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire samples for close checking work.

Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 19 and 21, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance pyrometer, Parr and Mahler-Bamb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead, and is best adapted to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. 0 Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ in. centrifugal pumps, a vacuum pump, an air

compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The smelting machinery consists of a 30 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with six metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat treatments and for metallography.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus by the department, upon the payment of a small fee. Each student has his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum.

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Bad-lands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique rock section of the Homestake mine, donated by the Homestake Mining Company of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards of hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The school is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops

In the basement of the Main Building a small machine shop is provided, containing a machine

lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for the design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the upper classes are granted permission to use the facilities offered by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department, a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Nine have been published. They are as follows:

Bulletin No. 1.—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. (*Out of print*).

By F. R. Carpenter and H. O. Hofman.

Bulletin No. 2.—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3.—Cyanide Experiments on the

Silicious Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4.—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. (*Out of print*). By C. C. O'Harra.

Bulletin No. 5.—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton.

Bulletin No. 6.—The Mineral Wealth of the Black Hills; 88 pages. 1902. (*Out of print*). By C. C. O'Harra.

Bulletin No. 7.—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8.—The Cement Resources of the Black Hills. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr. and C. H. Fulton.

Bulletin No. 9.—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra.

Bulletin No. 10—The Minerals of the Black Hills; 200 pages. 1914. By Victor Zeigler.

The Pahasapa Quarterly. This is a magazine published by the students with the assistance and general supervision of the faculty. As its name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

STUDENTS' EXPENSES

Tuition

The tuition and incidental fee is $6 per semester, or $12 per year, *payable in advance on registration.* This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees.

Fees enumerated below cover the bare cost of materials and supplies consumed in the laboratories and loss due to breakage, etc.

All fees are payable at the beginning of each semester, on registration. (Consult Departments of Instruction for description of courses.)

Chemistry 3-4, Elementary Chemistry, per semester ..... $ 4.00
Chemistry 11-12, Qualitative Analysis, per semester 7.00
Chemistry 17-18, Quantitative Analysis, per semester 8.00
Chemistry 21-22, Metallurgical Analysis, per semester 8.00

Metallurgy 24, Assaying, per semester 25.00
Metallurgy 19-21, Metallurgical Laboratory, per semester 5.00
Metallurgy 23, Cyanide Laboratory 25.00
Mineralogy 1, General Mineralogy, per semester 5.00
Mineralogy 2, Blow-pipe Analysis, per semester 5.00
Geology 3-4, Petrography, per semester 2.00
Physics 3-4, Elementary Physics, per semester 1.00
Physics 7-8, Advanced Physics, per semester 2.00
Engineering 1-2, Mechanical Drawing, per year 1.00
Engineering 3-4, Descriptive Geometry, per year 1.00
Engineering 5-6, Surveying, per semester ... 3.00
Engineering 9, Machine Design 1.00
Preparatory Science, per semester 2.00
Chemistry, all courses, deposits to cover breakage, etc 5.00
Metallurgy, all courses, deposits to cover breakage 5.00
Fee for bachelor's degree 5.00
Fee for Advanced degree 10.00
Athletic Association Fee, per year 5.00
Fee for permit for "conditioned" examination 2.00

(Note—No platinum is furnished by the Department of Chemistry.)

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $7.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $4.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $3.00 for the year.

Living Expenses

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $4.50 upwards per week. This makes the expense for board and room for the school year of 37 weeks range from $185 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books

Freshman year	$13.00
Sophomore year	17.00
Junior year	23.00
Senior year	19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshman year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added according to individual taste.

Incidental Expenses

Students are required, at various times, to

take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshmen year usually costs the student about $10. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

Students' Organizations and Athletics

The student organizations are the Students' Association and the Athletic Association. The Students' Association has for its aim the general welfare of the student body. The Athletic Association has for its aim the furtherance of legitimate

athletics, and maintains football, baseball and basketball teams, and track athletics. Membership in this association is obligatory, all students paying the annual fee of $5.00. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits.

Conduct

The school has no codified rules of conduct. Students are held to a strict account of their work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

Determination of Minerals and Assaying

Minerals are determined free of charge. Assays for gold and silver, etc., and chemical analyses both quantitative and qualitative, are made at reasonable rates. Prices will be sent upon application. All samples for analysis or assay and letters accompanying same should be addressed to the President of the School.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fourteen units are necessary for entrance.

Required Units

Arithmetic	1 unit
Algebra	1.5 units
Plane Geometry	1 unit

Solid Geometry	0.5 unit
English	2 units
History	1 unit
Physics	1 unit
Chemistry	1 unit
Total required units	9 units

Elective Units

German	1, 2 or 3 units
French	1, 2 or 3 units
Latin	2, 3 or 4 units
Greek	1 unit
Spanish	1 or 2 units
English	1 or 2 units
History	1 or 2 units
Mathematics	0.5 unit
Science	1 or 2 units
Drawing	1 unit
Shop Work	1 unit
Civil Government	0.5 unit
Bookkeeping	1 unit
Elective units required for entrance	.5 units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School

First: By Certificate. Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Second: By Examination. All other candidates for admission to the regular engineering courses will be required to pass entrance examinations in the subjects specified. These examinations are held at Rapid City on dates mentioned in the

calendar. Students who are deficient in subjects required for entrance into the regular engineering courses are permitted to enter the Preparatory Department, maintained by the school for the special purpose of preparing students so deficient.

Credentials for entrance should be in the hands of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units

Mathematics: The four and one-half units which may be offered in mathematics are as follows:

Arithmetic—One unit, complete, including the metric system.

Algebra—One and one-half units. The equivalent of A, B and C Algebra described under Preparatory Mathematics in the Preparatory Catalog.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Two units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Catalog.

Chemistry—One unit. The equivalent of ele-

mentary chemistry described in the Preparatory Catalog.

History—One unit. The History of the United States, English or Ancient History, as described under History, in the Preparatory Catalog.

Elective Units

The equivalent of courses, not mentioned above, described under Mathematics, (Trigonometry only), Languages, History, English and Preparatory Science, in the Preparatory Catalog.

Special Students

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

Short Course

A Short Course, of six weeks duration, will be offered hereafter, beginning each year with the assembling of school after the Christmas vacation. This course is designed for prospectors and miners and other men of maturity who have had practical experience but who have had no opportunity to acquire a technical education. For such men the school offers, during the midwinter weeks, an opportunity to gain some insight into those principles of their work which practice alone will not

provide. Instruction is given in the following subjects: Assaying, Cyaniding, Chemistry, Mineralogy, Geology, Ore Dressing and Mining Law. The tuition fee, payable at time of registration, will be six dollars plus the cost of such materials as may be used up in the laboratories.

A feature of interest is that men having ores or minerals of their own will be given opportunity to make tests upon them in so far as such can be done without interfering with the other work of the institution. Every effort will be put forth to make this work both practical and helpful. No credit toward a degree will be given for work pursued in this course.

Summer School

The summer school begins immediately after commencement. Three weeks are devoted by the Junior class to surveying in the field and underground, and one week by the Senior class to visits to mines and metallurgical works.

Preparatory Department

The School of Mines finds it necessary to maintain a Preparatory Science Course on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester. Small fees ranging from $1 to

$4 are required in Physics, Biology and Chemistry.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decides these cases upon the basis of individual merit.

Degrees

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineers' degrees should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Preparatory department will receive a certificate to that effect.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree. This thesis will be assigned to the individual members of the Senior class by a special thesis committee of the faculty. The standard form of thesis shall be the working out of plans for the development of an hypothetical mine, such subject to be assigned to all students except that the thesis committee may vary the subject as its judgment dictates. Report of progress in thesis work must be made at stated intervals to the theses committee. Theses must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning theses are fully satisfied.

The following is a list of the theses submitted since 1903:

1904. Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

1905. Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

1906. Coolidge, E. B., and Gains, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

1907. Bryant, Frank, An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report

on the Hematite and Delaware Mines Including Metallurgical Treatment.

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on the Coolgarde Group of Claims, Ida Gray Mining District.

1908. Coolidge, Cyril and Overpeck, Lem. S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

1909. Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

1910. Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of its Ore.

Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

1911. Anderson, Wm. L. Investigation of White

Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Windsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

1912. Dickey, S. C., and Mosier, P. M. Preliminary Treatment in the Concentration of an Argentiferous Copper Ore.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

1913. Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

Courses and Departments

The courses given by the School of Mines are:

Mining Engineering Course .....4 years
Metallurgical Engineering Course .....4 years
Civil Engineering Course .....4 years
Electrical Engineering Course .....4 years

SYNOPSIS OF COURSES

Mining Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	

Chemistry 5—General chemistry	48	
Chemistry 9, 11—Qualitative analysis	32	144
Geology 1—General geology	64	48
Engineering 1—Mechanical drawing .		96
English 9—Composition	64	
Mathematics 11—Algebra	32	
	320	288
Hours per week	20	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry ..	80	
Chemistry 6,8—General chemistry ...	48	48
Chemistry 10,12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing..		96
English 10—Composition	64	
Mathematics 12—Algebra	32	
	304	288
Hours per week	19	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry ..	32	
Chemistry 15, 17–Quantitative analysis	32	144
Mineralogy 1—General mineralogy .	48	48
Engineering 3—Descriptive geometry		96
Engineering 5—Surveying	48	48
	240	336
Hours per week	15	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry .	32	
Chemistry 16, 18–Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis ...	16	96
Engineering 4—Descriptive geometry		48
Engineering 6—Surveying	24	48

Metallurgy 2—General metallurgy ..	48	
Mining 2, 4—Mine surveying	24	Summer
	256	336
Hours per week	16	21

Third Year

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	
Geology 3—Physical geology	48	
Mineralogy 3—Optical mineralogy ..	16	48
Engineering 7–Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	312	288
Hours per week	19½	18

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Engineering 14—Mechanics of materials	64	
Geology 4—Petrography	48	48
Economics	48	
Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking .	48	
	320	336
Hours per week	20	21

Fourth Year

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Geology 5—Economic geology	64	

Mining 7—Drainage, transportation..	32	
Mining 9—Shaft sinking, exploitation	48	
Metallurgy 5—Gold and silver	48	
Metallurgy 9—Copper and lead	32	
Mining 11—Mine design		96
Mining 13—Mining Law	16	
Metallurgy 19—Laboratory		48
Thesis		48
	304	240
Hours per week	19	15

Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics ..	32	
Engineering 18—Hydraulics	32	24
Geology 6—Economic geology	64	
Mining 8—Mine administration	32	
Mining 10—Ventilation and lighting, placer mining, mine examination	48	
Metallurgy 6—Iron and steel	32	
Engineering 20—Power plants	32	24
Mining 12—Mine designing		96
Mining 14—Mine accounting		32
Metallurgy 20—Mill run		48
Thesis		96
	272	320
Hours per week	17	20

Metallurgical Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9,11—Qualitative analysis.	32	144
Geology 1—General geology	64	48
Engineering 1—Mechanical drawing .		96
English 9—Composition	64	

Mathematics 11—Algebra	32	
	320	288
Hours per week	20	18
Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry ..	80	
Chemistry 6, 8—General chemistry ..	48	48
Chemistry 10, 12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Engineering 2—Mechanical drawing.		96
English 10—Composition	64	
Mathematics 12—Algebra	32	
	304	288
Hours per week	19	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry ..	32	
Chemistry 15, 17—Quantitative analysis	32	144
Mineralogy 1—General mineralogy ..	48	48
Engineering 3—Descriptive geometry		96
Engineering 5—Surveying	48	48
	240	336
Hours per week	15	21
Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry .	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis ...	16	96
Engineering 4—Descriptive geometry		48
Engineering 6—Surveying	24	48
Mining 2, 4—Mine surveying 24		Summer
Metallurgy 4—General metallurgy ...	80	
	288	336
Hours per week	18	21

Third Year

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	
Chemistry 19, 21—Quantitative analysis	48	96
Engineering 7—Topographical drawing		24
Engineering 9—Machine design		96
Engineering 11—Graphics	8	24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	296	336
Hours per week	18½	21

Second Semester—	Lectures	Lab.
Physics 6,8—General physics	64	96
Engineering 14—Mechanics of materials	64	
Chemistry 20, 22—Quantitative analysis	16	32
Economics	48	
Metallurgy 24—Assaying	32	144
Engineering 12—Graphics	16	48
Mining 6—Tunneling, shaft sinking	48	
	288	320
Hours per week	18	20

Fourth Year

First Semester—	Lectures	Lab.
Engineering 15—Electrical engineering	64	48
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Gold and silver	32	
Metallurgy 11—Copper and lead	80	
Metallurgy 13—Metallurgical calculations	16	

Metallurgy 21—Metallurgical laboratory		96
Mining 13—Mining law	16	
Mining 7—Drainage, transportation	32	
Metallurgy 23—Laboratory		144
Thesis		48
	288	336
Hours per week	18	21
Second Semester—	Lectures	Lab.
Engineering 16—Thermodynamics	32	
Engineering 18—Hydraulics	32	24
Engineering 20—Power plants	32	24
Metallurgy 8—Gold and silver	16	
Metallurgy 6—Iron and steel	32	
Mining 14—Mining accounting		32
Metallurgy 18—Metallurgical design		96
Metallurgy 20—Mill run		48
Metallurgy 10—Electrometallurgy	32	
Metallurgy 12—Zinc and minor metals	32	
Metallurgy 14—Metallurgical calculations	16	
Mining 8—Mine administration	32	
Thesis		96
	256	320
Hours per week	16	20

Civil Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	..
Chemistry 5, 7—General and analytical chemistry	48	96
Geology 1—General geology	64	48
English 9—Composition	64	
Mathematics 11—Advanced algebra	32	

Engineering 1A—Mechanical drawing		144
	288	288
Hours per week	18	18
Second Semester—	Lectures	Lab.
Mathematics 8—Analytical geometry	80	
Chemistry 6, 8A—Gen. and analytical chemistry	48	96
Geology 2—General geology	64	48
English 10—Composition	64	
Mathematics 12—Advanced algebra ..	32	
Engineering 2A—Mechanical drawing		144
	288	288
Hours per week	18	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial Chemistry .	32	
Mineralogy 5—General mineralogy ..	32	48
Engineering 5A—Surveying	80	96
Physics 5, 7—General physics	64	48
Engineering 3—Descriptive geometry		96
	288	288
Hours per week	18	18
Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry ..	32	..
Engineering 8—Astronomy	32	48
Engineering 6A—Surveying	80	96
Physics 6, 8—General physics	64	48
Engineering 4A—Descriptive geometry		96
	288	288
Hours per week	18	18

Summer Surveying, six weeks.

Third Year

First Semester—	Lectures	Lab.
Physics 9—Analytic Mechanics	64	
Railroad Engineering	64	
Engineering 7A—Topographic drawing	16	96
Engineering 11—Graphics	16	48
Metallurgy—Iron and Steel	32	
Mathematics—Least squares	16	
Engineering 9—Machine design		96
Mining 5—Excavations	48	
Sociology	48	
	304	240
Hours per week	19	15

Second Semester—	Lectures	Lab.
Engineering 14A—Mechanics of Materials	80	
Testing of Materials	32	96
Mining 6—Tunneling	48	
Engineering 12—Graphics		48
Stereotomy		96
Cement and Concrete	32	
Engineering 20—Power plants	32	48
Economics	48	
	272	288
Hours per week	17	18

Fourth Year

First Semester—	Lectures	Lab.
Roofs and Bridges	80	96
Engineering 15—Electrical engineering	64	48
Dams and Retaining Walls	48	
Arches, Masonry and Foundations	48	48
Roads and Pavements	48	
Thesis		96
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Roofs and Bridges	48	96
Hydraulics	64	48
Sewers	32	
Contracts and Specifications	16	
Irrigation, Water Power and Supply	80	
Framed Structures	48	48
Thesis		96
	288	288
Hours per week	18	18

Electrical Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5, 7—Gen. and analytical chemistry	80	96
English 9—Composition	64	
Engineering 1—Mechanical drawing		96
Shop Work		96
Electricity	32	48
Mathematics 11—Advanced Algebra	32	
	288	336
Hours per week	18	21

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	80	
Chemistry 6, 8A—General and analytical chemistry	48	96
English 10—Composition	64	
Engineering 2—Mechanical drawing		96
Shop Work		96
Electricity	32	48
Mathematics 12—Advanced algebra	32	
	256	336
Hours per week	16	21

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry	32	
Engineering 5—Surveying	48	48
Engineering 9—Machine Design		96
Enginering 3—Descriptive geometry.		48
Physics 5, 7—General physics	64	48
Machine Shop		48
	224	288
Hours per week	14	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	
Engineering 6—Surveying	48	48
Enginering 12—Graphics		48
Engineering 4—Descriptive geometry		96
Physics 6, 8—General physics	64	96
	224	288
Hours per week	14	18

Third Year

First Semester—	Lectures	Lab.
Mathematics—Differential equations.	48	
Physics 9—Analytic mechanics	64	
Electrical Engineering—general	80	
Direct Current Laboratory		96
Electrical Measurements		48
Electrical design		96
Physics—Light and electrical theory.	32	
Sociology	48	
	272	240
Hours per week	17	15

Second Semester—	Lectures	Lab.
Engineering 18—Hydraulics	48	48
Engineering 16—Thermodynamics	32	

Engineering 20—Power plants	32	48
Engineering 14—Mechanics of materials	64	
Economics	48	
Metallurgy—General metallurgy	48	
Alternating Current Laboratory		48
Electrical measurements		48
Testing Laboratory		48
	272	240
Hours per week	17	15

Fourth Year

First Semester—	Lectures	Lab.
Alternating and Polyphase Current Theory	48	
Electrometallurgy	32	
Electrical Distribution and Control	48	
Electrochemistry	48	
Alternating Current Machinery	64	
Electrical Laboratory		96
Electrical Design		96
Thesis		96
	240	288
Hours per week	15	18

Second Semester—	Lectures	Lab.
Advanced Hydraulics	48	
Telegraphy and telephony	32	
Electric Railways	48	
Steam Turbines	32	
Illumination	32	
Electric Power Stations	48	
Electric Laboratory		96
Electrical Design		96
Thesis		96
	240	288
Hours per week	15	18

Preparatory Science Course

First Year

First Semester—	Lectures	Lab.
Civil Government	5	
English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient history	5	
Wood Shop		6
	18	9

Second Semester—	Lectures	Lab.
Arithmetic	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediæval history	5	
Wood Shop		6
	18	9

Second Year

First Semester—	Lectures	Lab.
Mathematics 1—Algebra	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Machine Shop		3
	18	6

Second Semester—	Lectures	Lab.
Mathematics 2—Algebra	5	
English 4—Rhetoric	5	
History 4—U. S. history	5	
Biology 4—Botany	3	3
Machine Shop		3
	18	6

Third Year

First Semester—	Lectures	Lab.
Mathematics 3—Geometry	5	
German 1	5	
Biology 5—Zoology	3	6
English 5 or 7—English or American Literature	5	
Freehand Drawing		3
	18	9

Second Semester—	Lectures	Lab.
Mathematics 4—Geometry	5	
German 2	5	
Astronomy	3	3
English 6 or 8—English or American Literature	5	
Physical Geography	3	3
Freehand Drawing		3
	21	9

Fourth Year

First Semester—	Lectures	Lab.
Chemistry 1-3	3	6
German 3	5	
Physics 1-3	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures	Lab.
Chemistry 2-4	3	6
German 4 or 6	5	
Physics 2-4	4	6
Mathematics 6—Algebra	5	
	17	12

Department of Geology and Mineralogy

PROFESSOR O'HARRA PROFESSOR ZIEGLER

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, endesite, dacite, etc., occur in

the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2

PROFESSOR O'HARRA

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time alotted to these subjects is devoted to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to

geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year: Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Chamberlain and Salisbury's College Geology.

Minerology 1

PROFESSOR ZIEGLER

General Mineralogy: This course is planned to develop such information as may be needed for the quick and accurate determination of mineral species in the field. The course is based on lectures and laboratory work and embraces frequent rigid quizzes on features of chief importance. The physical properties of minerals are dealt with in the early part of the course; a brief study of crystallography introduces this part of the subject. This is followed by a careful physical study of the chief economic and other minerals, except silicates, in systematic order. Good collections, containing most of the common species of minerals and many of the rare ones, are arranged for convenient use in the museum and the laboratory. Every student is expected to identify a collection of about 1500 unlabeled minerals; in addition, thoroughly accurate observation of labeled specimens from

many localities is insisted upon, and every attention is given to simple practical methods in the determination of unknown minerals.

Sophomore Year, First Semester: Three lecture periods and three laboratory hours per week.

Text Book: Moses and Parson, Mineralogy, Crystalography, and Blow-pipe Analysis.

Mineralogy 2.

PROFESSOR ZIEGLER

General Mineralogy and Blow-pipe Analysis: This course is a continuation of course 1 and has the same object in view, i. e., the teaching of quick methods of mineral determination. In the lecture work the silicates are taken up in systematic order, special attention being given to the rock making minerals, such as the feldspars, feldspathoids, pyroxenes, amphiboles, etc., their relationship, methods of formation, occurrence in nature, and association. A summary of the gem minerals, and the secondary silicates is included. In the laboratory work, the first third of the semester is devoted to the study of blow-pipe methods, known minerals being used. After this, the student is given only unlabeled specimens, the nature and same of which he is required to learn, keeping for reference a detailed record of all results obtained. It is expected that, upon completing this and the preceding course, the student will have gained a fair working knowledge of approximately two hundred of the common minerals, including the chief features of their distribution, uses, value and output.

Sophomore Year, Second Semester: One lecture period and six laboratory hours per week.

Text Book: Brush and Penfield, Determinative Mineralogy and Blow-pipe Analysis.

Mineralogy 3

PROFESSOR ZIEGLER

Optical Mineralogy: This course is mainly introduced to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs, and indicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent "Zeiss" microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz. Practice is given in the making of thin sections.

Junior Year, First Semester: Mining Engineering Option: One lecture period and three laboratory hours per week.

Text Book: Luquer, Minerals in Rock Sections.

Mineralogy 5

PROFESSOR ZIEGLER

Similar to Mineralogy 1, but modified for Civil Engineering students.

Sophomore Year, First Semester: Two lectures and three laboratory hours per week.

Geology 3.

PROFESSOR ZIEGLER

Physical Geology: The purpose of this course is to bring out in some detail certain important

features, too briefly considered in General Geology that have a close connection with the subjects of Petrography and Economic Geology, which follow. The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations, is next taken up, followed by a brief summary of the modern ideas on diastrophism, including earthquakes, folding, and faulting. The physical action of underground water, its circulation, and its influence on the rocks receive careful attention. Thus, processes of denudation, and deposition, and the formation and the classification of sedimentary rocks are emphasized. In this as well as in other courses those factors having a direct bearing on Petrography and Economic Geology will receive particular attention.

Junior Year, First Semester, Mining Engineering Option: Three lecture periods per week.

Text Book: Lecture Notes.

Geology 4.

PROFESSOR ZIEGLER

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rock, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Zirkel and Rosenbusch. modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence, and relations of rock masses and contact metamorphism are included. The principles or regional metamorphism and a classification of metamorphic rocks follow. For

the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with acompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, Second Semester, Mining Engineering Option: Three lecture periods, and three laboratory hours per week.

Text Book: Kemp, Handbook of Rocks. Luquer, Minerals in Rock Sections. Lecture Notes.

Geology 5-6

PROFESSOR O'HARRA

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are free-

ly used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology of the United States; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits.

Department of Mining

PROFESSOR EHLE

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by students on a scale approaching commercial practice.

A summer school of mining is held each year immediately following the close of school in June. A suitable mining locality having been selected,

students under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Junior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valued assets.

The following courses are offered by the department:

Mining 1-3

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Four lecture periods and three laboratory hours per week.

Mining 2-4

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year, Second Semester: Three lecture periods per week for eight weeks.

The field work of this course occupies two weeks of the summer school in June, between the Junior and Senior years, and with the subsequent calculation and plotting of notes here obtained, completes the course.

Mining 5

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Junior, First Semester: Three lecture periods per week.

Mining 6.

Tunneling: The driving of mine tunnels and drifts through rock and through soft or running ground; comparative costs; general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Hygienic Conditions: Surface arrangements

for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Junior Year, Second Semester: Three lecture periods per week.

Mining 7.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive powers; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tram ways and ærial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 8

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Senior Year, Second Semester: Two lecture periods per week.

Mining 9

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and

masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester: Three lecture periods per week. Mining Engineering Option.

Mining 10.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging; costs and results.

Mine Examination: Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties; forms of report.

Senior Year, Second Semester: Three lecture periods per week. Mining Enginering Option.

Mining 11-12.

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power need-

ed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 13.

MR. C. L. LEWIS

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate; the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, First Semester: One lecture period per week for twelve weeks.

Mining 14

PROFESSOR EHLE

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of

cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Senior Year, Second Semester: Two lecture periods per week.

Department of Engineering

PROFESSOR STEELE

The aim of this department is to give the student such training in the class room, drawing room and field as will properly fit him for his career as a mining engineer.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size; lecture room and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Engineering 1-2

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometic and cabinet projections, machine details, and both free hand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the repartment at cost:

One set of drawing instruments containing:

One pair of 6 in. Compasses, with pen, pencil and needle points.
One pair 6-in. Dividers.
One 5½ in. ruling pen.
One 3½ in. Steel Spring Bow Divider.
One 3½ in. Steel Spring Bow Pencil.
One 3½ in. Steel Spring Bow Pen.
One T Square with 30 in. blade.
One 4½ in. Protractor.
One Irregular Curve.
One 7 in. 30° by 60° Triangle.
One 8 in. 45° Triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Engineering 1A-2A

Mechanical Drawing: Similar to Engineering 1-2, but nine hours per week during the Freshman Year. Isometric and oblique projection and structural drawing will be given special attention. A small amount of time will be devoted to architectural drawing.

Engineering 3-4

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six lab-

oratory hours per week; second semester, three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Engineering 4A

Descriptive Geometry: Similar to Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six laboratory hours per week.

Engineering 5-6

Surveying: It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, geodetic surveying, including the measurement of a base line; measurement of the horizontal angles; computation for the adjustment of the triangulation system; determination of the meridian by means of the solar instrument;

determination of latitude; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Sophomore Year, First Semester: Three lecture periods and three hours field work per week; second semester, three lecture periods per week for eight weeks and three hours field work per week for the whole semester.

A two weeks' summer school for practical work immediately follows the close of school in June, and completes the course in general surveying.

Text Book: Johnson's Theory and Practice of Surveying.

Engineering 5A-6A.

Surveying: Course similar to Engineering 5-6, but amplified for Civil Engineering students. Five hours lectures and six hours field work per week during the Sophomore year, followed by six weeks summer field work.

Engineering 7.

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles.Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Engineering 5-6.

Junior Year: Three laboratory hours per week for eight weeks.

Engineering 8

Astronomy: A short course for engineering students. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second

Semester: Two lectures and one evening for observation per week.

Engineering 9.

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. The application to mining machinery is always kept in mind. Drafting room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week.

Engineering 11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amount of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: One lecture period and three laboratory hours for eight weeks of the first semester and all of the second semester.

Text book: Hoskins, Elements of Graphic Statics.

Engineering 14

Strength of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of

beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Engineering 15.

PROFESSOR VAN NUYS

Electrical Engineering: This course deals with the principles and general construction of dynamo-electric machinery; systems of direct current distribution; direct current motors, their action, control and application; lighting equipments; the design; installation and operation of electric power plants, the principles and general construction of alternating and polyphase dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments in the operation and testing of direct and alternating current generators, motors, and transformers, in electrical measurements, and photometry of electric lamps.

Senior Year, First Semester: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Franklin & Esty, Elements of Electrical Engineering, 2 Vols.

Engineering 16.

PROFESSOR VAN NUYS

Thermo-Dynamics: This course begins with

a discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engins, air compressors and refrigerating machines are fully discussed.

Senior Year, Second Semester: Four lecture periods per week for eight weeks.

Engineering 18.

PROFESSOR VAN NUYS

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 5, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water. He learns the methods of commercial measurement of water by both weir and orifices. The problems include the computation of diameters of pipes; pressure and energy of confined water; dimensions of channels and ditches; velocity of flow, etc.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for weir and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have oportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Four lecture periods and three laboratory hours per week for eight weks.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Engineering 20

PROFESSOR STEELE

Power Plants: This course applies practical-

ly the principles developed under thermodynamics.. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and kerosene engine. This apparatus is also available for laboratory work in this course.

Senior Year, Second Semester: Two lecture periods per week for the semester and three laboratory hours per week for eight weeks.

Department of Physics

PROFESSOR VAN NUYS

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

Especial attention is given to the general laws underlying the science, and the history of the discovery and development of the important results is considered carefully. In the laboratory courses, the purpose is to excite in the student an interest in experimentation and to develop the ability for careful observation and the testing and sifting of results.

The courses offered by the department are as follsws:

Electricity

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Freshman Year, Electrical Engineering course. Two hours lectures and three hours laboratory per week.

Physics 5

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the sub-

ject, while the more theoretical results are considered in Physics 9. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics. The complete treatment of the latter here serves as an introduction to the study of hydraulics in the Senior year.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics in the Senior year.

Junior Year, First Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 6.

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, potential electromagnetism and electromagnetic induction are studied in detail, and a comprehensive consideration of electrical measuring instruments, dynamos and motors, is entered into. The course closes with a development of the laws of alternating currents and a study of alternating current machinery and transformers. This course is a necessary preparation for the course in electrical engineering in the Senior year.

The subject of light is considered from the standpoint of the electro-magnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Watson's Text Book of Physics.

Physics 7.

Laboratory course to accompany Physics 5.

The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity of solids, liquids and gases, acceleration of gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of calorific power of fuels, specific and latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves.

Junior Year, First Semester: Three laboratory hours per week.

Physics 8.

Laboratory course to accompany Physics 6: The laboratory is well equipped for an extensive course in electrical testing. The apparatus includes a complete set of Weston meters, including voltmeters, millivoltmeters, ammeters, millameters, alternating current voltmeters, and ammeters, electro-dynamometers, fluxmeters, magnetometers, potentiometers, permeameters, voltameters, Wheatstone bridges, many types of galvanometers, condensers, induction coils, static machines, Tesla transformers, X-ray tubes, wireless telegraph, etc. Dynamos, motors and electric lamps of various types are at hand for the purpose of making tests of commercial efficiency.

The equipment for optical measurements is ample and includes optical benches for refraction, interference, diffraction, polarization, for use with projection apparatus, spectroscopes, spectrometers, polariscopes, heliostats, photometers, etc.

The school machine shop is at the disposal of

students for the purpose of constructing apparatus for research work.

Junior Year, Second Semester: Six laboratory hours per week.

Physics 9.

Analytic Mechanics: The theory is developed by lectures. Many problems will be solved to enforce the principles and to develop ability in the student to apply what he has learned to practical problems. Particular effort is made to cultivate the power of the student to use calculus methods when needed. The course includes the following subjects:

Statics: First principles; units, composition and resolution of concurring forces; composition and resolution of forces acting on a rigid body; conditions of equilibrium; center of gravity; friction, virtual velocities; machines; the funicular polygon and the catenary.

Kinematics: Rectilinear and curvilinear motion; composition and resolution of acceleration; angular velocity and angular acceleration; projectiles, etc.

Kinetics: Laws of motion; motion under the action of a variable force; motion in a resisting medium; constrained motion; the simple pendulum; centripetal and centrifugal forces. Impact; work and energy; moment of inerta.

Junior Year, First Semester: Four lecture periods per week.

Text Book: Bowser's Analytic Mechanics; the works of Church, DuBois, Hoskins, Johnson, Lanza, Todhunter, and Routh, are used for reference.

Department of Chemistry

PROFESSOR COOLBAUGH

The courses in chemistry are designed to give to mining and to metallurgical engineers the knowledge of chemistry most essential to their work. Especial emphasis is given to the laws underlying the science; the separations, estimations, etc., being made with these principles in mind. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation, and to teach the proper correlation of the results of experiments.

Chemistry 5-6.

General Chemistry: Lectures. This course is designed to give to the student a knowledge of the principal theories and laws of the science. The following subjects are discussed in an elementary way: Atoms and molecules, gases, liquids, solids, solutions, thermo and electro-chemistry, and chemical equilibrium. Special attention is given to those portions of the subject bearing upon osmotic pressure, freezing and boiling points of solutions, electrolytic dissociation and the law of mass action. A small amount of time is also given to the consideration of organic chemistry.

Freshman Year: Three lecture periods per week throughout the year.

Reference Books: Newth's Inorganic Chemistry; Ostwald's Principles of Inorganic Chemistry; Jones' Elements of Physical Chemistry.

Chemistry 7.

Laboratory work to accompany Course 5 for Civil and Electrical Engineering students. Freshman Year, First Semester: Six laboratory hours per week.

Chemistry 8.

General Chemistry Laboratory: Inorganic preparations, the study of crystallization and distillation, the use of indicators, and the effect of mass upon the time and extent of reactions.

Freshman Year: Three laboratory periods per week for the second half year.

Chemistry 8A.

Laboratory work to accompany Course 6 for Civil and Electrical Engineering students. Freshman Year, Second Semester: Six laboratory hours per week.

Chemistry 9-10

Qualitative Analysis: Lectures. The work in qualitative analysis begins with an outline of the general scheme of analysis. Then follows a minute study of the metals and the acids radicals with their detections and separations. Emphasis is placed on the principles of oxidation and reduction, and the theories of ionization and hydrolysis. Separations are made before the class in order to give an idea of the correct use of reagents and of the methods for rapid manipulation.

Freshman Year, First Semester: Two lecture periods per week; second semester, one lecture per week.

Reference Books: Prescott & Johnson's Qualitative Analysis; Treadwell's Qualitative Analysis.

Chemistry 11-12

Qualitative Analysis: Laboratory. This cov-

ers the separation of metals and acids in solutions, dry mixtures, minerals, slags and alloys.

Freshman Year, First Semester: Nine laboratory hours per week; second semester, six laboratory hours per week.

Chemistry 13-14.

Industrial Chemistry: Lectures. The subjects considered in this course are acids, alkalis, sulphur, chlorine, bromine, iodine, cyanides, fertilizers, explosives, bricks, clays, cements, mineral paints, fuel and refractory materials.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Book: Thorp's Outlines of Industrial Chemistry.

Chemistry 15-16.

Quantitative Analysis: Lectures. The work in quantitative analysis consists of discussions of the relative merits of methods applied in the laboratory, the study of articles and reviews from chemical periodicals, and the subject of chemical calculations.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Books: Miller's Quantitative Analysis; Miller's Calculations of Analytical Chemistry; Treadwell's Quantitative Analysis; Sutton's Volumetric Analysis; Low's Technical Methods of Ore Analysis.

Chemistry 17-18

Quantitative Analysis: Laboratory. The course covers the subject of mineral analysis, including both gravimetric and volumetric methods. The analyses required are: Magnesium sulphate, sodium or other chloride, potassium alum, coal, iron ammonium alum, iron ore, pig iron, spiegel or man-

ganese ore, zinc ore, copper ore or matte, brass, lead ore, chromic iron, limestone, arsenic ore, antimony ore, slag, and gas analysis.

Sophomore Year: Nine laboratory hours per week throughout the year.

Chemistry 19-20.

Metallurgical Chemistry: Lectures. This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. The subjects studied are: The technical methods connected with the metallurgy of iron, steel, zinc, lead and copper; the determinations of bismuth, mercury, cadmium, tin, nickel and the rare elements of commercial importance, and the analysis of electrolytic slimes.

Prerequisites: Chemistry 2, 3 and 4, or equivalents.

Junior Year, First Semester: Three lecture periods per week; second semester, one lecture period per week. Required of Juniors taking the metallurgical option.

Chemistry 21-22.

Quantitative Analysis: Laboratory. Work corresponding to Chemistry 19-20.

Junior Year, First Semester: Six hours per week; second semester, two hours per week.

Department of Metallurgy

PROFESSOR CROOK.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a fur-

nace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 2.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blast; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room, and hand in for examination, papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 19.

Sophomore Year, Mining Engineering Option, Second Semester: Three lecture hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 4.

Introductory Metallurgy: Same course as Metallurgy 2, but amplified by detail.

Sophomore Year, Metallurgical option, Second Semester: Five hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 5.

The Metallurgy of Gold and Silver: This course

consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is taken up in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is taken up. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior Year, both options, First Semester: Three hours per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook.

Metallurgy 6.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial at-

tention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, Second Semester: Two hours per week. Lecture notes.

Metallurgy 7-8.

The Metallurgy of Gold and Silver: This course comprises the detailed study of the Cyanide process. It is divided into two parts, the study of the text book and references and the compiling and delivering of lectures on assigned subjects by each of the students in turn. In this way the student becomes thoroughly familiar with the periodical literature as well as the standard books on the subject of cyaniding while preparing his lectures.

Text Book: Clennell, The Cyanide Handbook, References; Julian and Smart, Cyaniding Gold and Silver Ores; McFarren, Cyanide Practice; Volumes of the various technical periodicals.

Senior Year, Metallurgical Option, First Semester: two hours a week. Second Semester one hour a week.

Metallurgy 9.

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also

the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up, also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining Option, First Semester: Two hours per week.

Reference Works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting; Iles, Lead Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 10.

Electro-Metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, silver, lead, nickel and tin.

Electrothermic processes. Theory. The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc, and for miscellaneous purposes.

Senior Year, Metallurgical Option, Second Semester: Two hours per week.

No text book required. Reference works: Stansfield, The Electric Furnace; Borches, Electric Smelting and Refining.

Metallurgy 11.

The Metallurgy of Copper and Lead: The same as Metallurgy 9, except that it is amplified by detail.

Senior Year, Metallurgical Option, First Semester: Five hours per week.

Text Books: Peters' Practice of Copper Smelting; Hofman's Metallurgy of Lead.

Metallurgy 12

The Metallurgy of Zinc and the Minor Metals: The roasting of zinc ores; zinc distillation furnaces; the distillation process; the purification of spelter; commercial considerations. The metallurgy of nickel, antimony, tin, bismuth, tungsten and arsenic.

Senior Year, Metallurgical Option, Second Semester: Two hours per week.

No text book required. Reference Works: Ingalls, The Metallurgy of Zinc and Cadmium; Schnabel, Handbook of Metallurgy, Vol. II.

Metallurgy 13-14

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important calculations in connection with the practice of thermo-chemistry, copper smelting, lead smelting, and electro-metallurgy.

Metallurgical Option, Senior Year: One hour per week for both semesters.

Metallurgy 18

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5-stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Nine laboratory hours per week for the second semester.

Metallurgy 19.

Metallurgical Laboratory: Laboratory prac-

tice in pyrometry; calibration of the thermo-couple with use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 20.

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 21.

Metallurgical Laboratory: Course similar to Metallurgy 19, but amplified.

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 23.

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester: Nine hours per week.

Metallurgy 24.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents; the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and the excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloys for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Fulton, Manual of Fire Assaying.

Metallurgical Research.

Research Work: Time and fees by arrangement.

Department of Mathematics

PROFESSOR McLAURY

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year

or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses.

Mathematics 7.

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8.

Analytic Geometry: This course includes the following subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry, with Smith & Gale, Puckle, Ashton and C. Smith for reference.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Snyder & Hutchinson, Murray and Williamson are used for reference.

Mathematics 10

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11

Algebra: This course will be a review of Elementary Algebra including logarithms.

Freshman Year, First Semester: Two lecture periods per week.

Mathematics 12

Algebra: This course will include the following subjects: properties of quadratics, ratio and proportion, variation, progression, indeterminate coefficients, binomial theorem, variables and limits, series, general properties of equations, numerical equations.

Freshman Year, Second Semester: Two lecture periods per week.

Department of English

PROFESSOR McLEARIE

The aim of this department is to give the student a command of good idomatic English and to aid him in the development of the art of expression. Especial emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Wendell's English Composition; Pearson's Principles of Expression; Baldwin's College Manual of Rhetoric.

English 10.

This course supplements the work of the first semester by giving further practice in narrative,

expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Economics.

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

List of Students, 1913-14

Graduate Student

Alder, Alfred Jr., B. S., 1913 .....Volin, S. D.

Senior Class.

Bochert, W. C. .....Rapid City, S. D.
Eldredge, Robert B. ..... Colorado Springs, Colo.
Fahrenwald, Arthur W. .....Rapid City, S. D.
Farnham, Lloyd L. .....Sioux City, Iowa
Fleischman, Leo ..... New York, N. Y.
Hill, Robert S. .....Rapid City, S. D.
McCauley, Willard J. .....Aberdeen, S. D.
Meents, R. O. .....Boulder, Colorado
Pryer, W. Cristy .....Aberdeen, S. D.
Stowell, George E. ..... Perry, Michigan

Junior Class

Booth, Lionel E. ..... Virginia, Minnesota
Borst, O. H. ..... Pierre, S. D.
Dennis, Paul .....Hot Springs, S. D.
Gates, Clyde .....Rapid City, S. D.
Holly, George .....Rapid City, S. D.
O'Harra, B. Marvel .....Rapid City, S. D.
Thiel, Arthur .....Alexandria, S. D.

Sophomore Class

Cragin, Rodney .....Arpan, S. D.
Hill, Joseph .....Rapid City, S. D.
Johnson, J. Harlan ..... Philadelphia, Pa.
McElroy, Jack .....Rapid City, S. D.
Richardson, George A. .....Rapid City, S. D.

Rugg, Harold H. .....Rapid City, S. D.
Smith, Elwyn .....Rapid City, S. D.
Wilmarth, J. B. .....Aberdeen, S. D.

Freshman Class

Alder, Herbert .....Volin, S. D.
Anderson, Leon .....Rapid City, S. D.
Deutsch, Harry .....Rapid City, S. D.
Haehner, Bernie .....Alexandria, S. D.
Hicks, Ralph S. .....Rapid City, S. D.
Holly, Maurice .....Rapid City, S. D.
Layman, Dale .....Rapid City, S. D.
Lenhart, Walter .....Rapid City, S. D.
Pavlik, George B. .....Verdigre, Neb.
Price, Virgil T. .....Rapid City, S. D.
Scanlon, James W. ..... Hermosa, S. D.
Snyder, William E .....Onida, S. D.
Turner, F. A. .....Faulkton, S. D.

Special Students

Sherman, Fred .....Maiden, Mont.
Thomas, Loren .....Rapid City, S. D.
Van Nuys, Laura .....Rapid City, S. D.
Watson, James .....Rapid City, S. D.

Preparatory Students

Biggs, Clifford .....Rapid City, S. D.
Brown, George .....Rapid City, S. D.
Burke, Timon .....Rapid City, S. D.
Clark, Edwin .....Rapid City, S. D.
Crabtree, Hampton .....Rapid City, S. D.
Crabtree, Verne .....Rapid City, S. D.
Crittenden, Donald .....Rapid City, S. D.
Curtis, Willard .....Rapid City, S. D.
Darling, Robert .....Rapid City, S. D.
Gates, Edgar .....Rapid City, S. D.
Gray, Carlyle .....Rapid City, S. D.
Harvey, William .....Rapid City, S. D.
Lane, Roland .....Rapid City, S. D.

Lee, Gladys .....Rapid City, S. D.
Lee, Myrtle .....Rapid City, S. D.
Lynch, Maurice .....Rapid City, S. D.
McCain, Galen .....Rapid City, S. D.
Morrisson, Edgar .....Rapid City, S. D.
Nelson, Harold .....Rapid City, S. D.
Newbowers, Frank .....Rapid City, S. D.
Norris, Paul .....Haydraw, S. D.
Oliver, Harold G. .....Rapid City, S. D.
Platt, Edward .....Rapid City, S. D.
Raybourne, Earl .....Rapid City, S. D.
Reeves, Ruth .....Rapid City, S. D.
Ronne, A. E. .....Rapid City, S. D.
Royse, Joseph B. .....Rapid City, S. D.
Ruth, Herman .....Central City, S. D.
Scott, George .....Rapid City, S. D.
Spencer, Edward .....Newell, S. D.
Sweeney, Peter .....Rapid City, S. D.
Sweeney, Tom .....Rapid City, S. D.
Thickston, A. J. .....Rapid City, S. D.
Van Meter, Edith .....Rapid City, S. D.
Warren, James .....Rapid City, S. D.
Wentworth, Henry .....Rapid City, S. D.
Weeks, Sanford .....Rapid City, S. D.
Wheelock, George .....Rapid City, S. D.

Short Course

Henault, Denis ..... Custer, S. D.
Sherman, Frank .....Pactola, S. D.

Alumni

Eighteen Hundred Eighty-Eight

John W. Hancher, B. S., M. S., South Dakota School of Mines; LL. D., Simpson College; 150 Fifth Avenue, New York, N. Y.

Eighteen Hundred Ninety

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S. Western Representative Gerhard-Mennen Chemical Co., Newark, N. J.

Eva Robinson, B. S., M. A. Professor of Home Economics, University of South Dakota, Vermillion, S. D.

Eighteen Hundred Ninety-One

Mrs. Otillie Behrens Alger, B. S., Hermosa, S. D.

Nineteen Hundred One

G. Howell Celevenger, B. S., E. M., South Dakota School of Mines; M. A., Columbia University; Associate Professor of Metallurgy, Stanford University, Canifornia.

Max Hopkins, B. S. With International Correspondence School of Scranton, Pa. Address, 1415 Majestic Building, Milwaukee, Wis.

Nineteen Hundred Two

Areli C. Overpeck, B. S., E. M. Superintendent Dakota-Calumet Mining Co., Hill City, S. D.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four.

U. S. S. Arentz, B. S., E. M. General Superintendent Nevada Douglas Copper Co., and Nevada Copper Belt R. R., Ludwig, Nev.

Arthur E. Hall, B. S., Met. E. Assistant Superintendent Copper Department, American Smelting and Refining Co., Omaha, Neb.

Elmer W. West, B. S., M. E. Mining Engineer, Thompson, Nev.

Guy E. Wolcott, B. S. Mining Engineer, Golita, Calif.

Nineteen Hundred Five

O. Allen Anderson, B. S., E. M. Mill Foreman, Alaska-Treadwell Mining Co., Juneau, Alaska.

James Halley, Jr. B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Mine Superintendent, Oliver Iron Mining Co., Virginia, Minn.

Nineteen Hundred Six

Edwin Coolidge, B. S., E. M. Mill Superintendent, Cumberland Mining Co., Maiden, Mont.

Harry T. Curran, B. S., E. M. Superintendent Argo Reduction Co., Denver, Colorado.

William Gains, B. S. Mill Foreman, Yellow Jacket Mining Co., Salmon City, Idaho.

B. D. O'Brien, E. E. Rose Polytechnic, 1896; B. S., E. M., South Dakota School of Mines. With Golden Reward Mining Co., Deadwood, S. D.

Louis L. Penhoel, B. S. Superintendent, Dexter Mining and Development Co., Atlantic City, Wyo.

J. Burns Read, B. S., E. M. Assistant Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Herbert Seiter, B. S. Mining Engineer, Omaha, Neb.

Earl Van L. Smith, B. S., Akron, Ohio.
Peter Whytock, B. S. Mining Engineer, National, Nevada.
Frederick Witherald, B. S., Boston, Mass.

Nineteen Hundred Seven

Frank Anderson, B. S. Engineer, Portland, Oregon. 204½ Washington St., care of Wells and Co.
Frank Bryant, B. S., E. M. Cumberland Mining Co., Maiden, Mont.
Wharton Cornell, B. S., 1711 Rodney St., Wilmington, Del.
Otto Ellerman, B. S., E. M. State Mine Inspector, Sturgis, S. D.
Bernard Matson, B. S., U. S. Assay Office, Deadwood, S. D.
Lloyd Mellinger, B. S. Assayer and Chemist, Mountain Copper Co., Martinez, Calif.
Milton Morris, B. S. With New York, Honduras and Rosario Mining Co., San Juancito, Honduras.
C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M. Columbia University. Professor of Physics, South Dakota School of Mines, Rapid City, S. D.
Charles Whitmore, B. S. Cashier Lincoln County Bank, Canton, S. D.
Leon Peck Wells, B. S. Engineer, Calumet and Arizona Mining Co., Box 1433, Bisbee, Ariz.

Nineteen Hundred Eight

Cyril Coolidge, B. S. With Rosario Mining Co., San Juancito, Honduras, C. A.
Ivan E. Goodner, B. S. Cyanide Chemist, Alaska-Treadwell Gold Mining Co., Treadwell, Alaska.
L. L. Hebblethwaite, B. S., Evanston, Ill.
Glen P. Ives, B. S., E. M. Mining Engineer, Box 962, Santiago, Chile.

Lem S. Overpeck, B. S. With Pennington County Bank, Rapid City, S. D.
Ignacio Diaz Ossa, B. S. Assayer and Metallurgist, Cassilla, 962, Santiago, Chile.
W. G. Sparling, B. S., Rapid City, S. D.
D. C. Woodard, B. S. Assayer and Metallurgist, Cassilla 962, Santiago, Chile.
Fred W. Winters, B. S., E. M. With Spotted Horse Leasing Co., Maiden, Mont.

Nineteen Hundred Nine

Jesse O. Betterton, B. S., M. E. Assistant Chemist, American Smelting and Refining Co., Omaha, Neb.
Roy F. Coolidge, B. S., E. M. Mill Superintendent, Kendall Gold Mining Co., Kendall, Mont.
Eli A. Hvistendahl, A. B., University of South Dakota; B. S., South Dakota School of Mines. With American Smelting and Refining Co., Omaha, Neb.
H. W. Jones, A. B., University of South Dakota; B. S., South Dakota School of Mines. Science Department, Jamestown High School, Jamestown, N. D.
Lewis W. Ledyard, B. S. Draftsman, Homestake Mining Co., Lead, S. D.
Willard C. Marshall, B. S. With Rapid City Pressed Brick Co., Rapid City, S. D.
Herbert N. Read, B. S., E. M. With Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Ten

Richard T. Bennett, B. S. United States Deputy Mineral Surveyor, Pierre, S. D.
John Wasson Eddy, B. S. Surveyor with C. M. & St. P. R. R., Stanford, Mont.
John Wing Elliott, B. S., Manager Columbus Auto Company, Columbus, Neb.

George Earl Flower, B. S. With Goodyear Tire and Tube Co., Akron, Ohio.

Zay Jeffries, B. S. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Arthur E. Sargeant, B. S. Purchasing Agent, Mogul Mine, Terry, S. D.

John William Stoner, B. S. City Auditor, Lead, S. D.

Joseph H. Saville, B. S., E. M. Chemist, Washoe Smelter, Anaconda, Mont.

Harry Ellis Wheelock, B. S. Mine Superintendent, Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Eleven

William L. Anderson, B. S. Mining Engineer, Leesburg, Idaho.

Floyd Brooks, B. S. Mining Engineer, Sudbury District, Worthington, Ontario.

Chester G. Ehle, B. S., Municipal Engineering Dept., Portland, Oregon.

Fred J. Muhmel, B. S., Scotland, S. D.

Elwin H. Quinney, B. S., M. E. With State Engineer, Pierre, S. D.

Frank H. Winsor, B. S. Chemist with Mason Valley Mines, Thompson, Nevada.

Clarence G. Willard, B. S. With Golden Reward Mining Co., Deadwood, S. D.

Ninteen Hundred Twelve

Samuel C. Dickey, B. S. Assayer for Mary Murphy Mining Co., St. Elmo, Colorado.

Frank A. Fahrenwald, B. S., South Dakota School of Mines, M. S. Pennsylvania State College. Metallurgist for American Dental Association, Case School of Applied Science, Cleveland, Ohio.

Peter Mosier, B. S. Assayer for Mary Murphy Mining Co., St. Elmo, Colorado.

Nineteen Hundred Thirteen

Alfred Alder, Jr., B. S. Assayer for Bismarck Mine, Flatiron, S. D.

Amil A. Anderson, B. S. Assistant Metallurgist, Homestake Mine, Lead, S. D.

J. M. Hartgering, B. S. Surveyor, Rapid City, S. D.

Hugh M. Henton, B. S. Assayer for Ruby Mining Co., Zortman, Mont.

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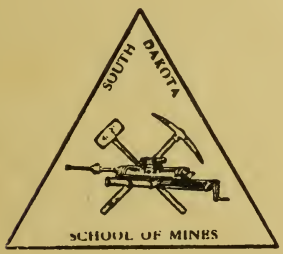
South Dakota State School of Mines

Annual Catalog 1914-1915



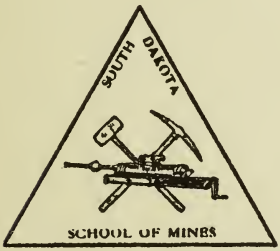
With Announcements
For 1915-1916

Rapid City, South Dakota

May, 1915

South Dakota State School of Mines

Annual Catalog
1914-1915



With Announcements
For 1915-1916

Rapid City, South Dakota

May, 1915

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SOUTH DAKOTA STATE SCHOOL OF MINES, RAPID CITY, S. D.

College Calendar

1915

Registration Committee considers applications for advanced standing and credentials for admission ..... September 14
School Year begins ..... Wednesday, September 15
Thanksgiving Recess....November 25 to 27 inclusive
Christmas Vacation begins ..... December 23

1916

Christmas Vacation ends ..... January 5
Short Course begins ..... January 10
Midyear Examinations ....January 24 to 29 inclusive
First Semester ends ..... January 29
Second Semester begins ..... January 31
Short Course ends ..... February 19
Washington's Birthday ..... February 22
Annual Field Trips ..... April 3 to April 10
Baccalaureate Sermon ..... May 21
Final Examinations ..... May 22 to 27 inclusive
Commencement and Conferring of Degrees, May 24

Regents of Education

Members of the Board

THEODORE W. DWIGHT, Sioux Falls,
Term expires January 1, 1921

ALBERT M. ANDERSON, Sturgis,
Term expires January 1, 1917

AUGUST FRIEBERG, Beresford,
Term expires January 1, 1919

FRANK ANDERSON, Webster,
Term expires January 1, 1917

J. W. CAMPBELL, Huron,
Term expires January 1, 1921

Officers of the Board.

THEODORE W. DWIGHT, President, Sioux Falls

IRWIN D. ALDRICH, Secretary, Big Stone City.
A. W. EWERT, (State Treasurer), Treasurer Ex officio

Regents Committee in Charge of the School of Mines.

ALBERT M. ANDERSON FRANK ANDERSON

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA

President and Professor of Geology
A. B., Carthage College; Ph. D., Johns Hopkins University.

*MELVILLE FULLER COOLBAUGH

Vice President and Professor of Chemistry.
B. S., Colorado College; A. M., Columbia University.

HOWARD LINCOLN McLAURY

Professor of Mathematics
A. B., Oberlin College; A. M., Harvard University

CLAUDE CORNELIUS VAN NUYS

Professor of Physics.
A. B., Yankton College; B. S., E. M., South Dakota State School of Mines; A. M., Columbia University.

JOSEPH HERBERT STEELE

Professor of Engineering.
B. S., C. E., Michigan Agricultural College

JOHN McLEARIE

Professor of English
A. B., Macalester College; A. M., University of Chicago.

CLARENCE LESLIE LEWIS

Lecturer on Mining Law.
University of Michigan

WELTON JOSEPH CROOK

Professor of Metallurgy.
Melbourne School of Mines; A. B., Leland Stanford University.

JOSEPH JAMES RUNNER

Professor of Mineralogy and Petrography
A. B., University of Nebraska.

THEODORE SAUNDERS DUNN

Professor of Mining.
B. S., M. S., Missouri School of Mines

*Absent on leave.

LESLIE DENIS SMITH
Acting Professor of Chemistry
B. S., Beloit College; Ph. D., Johns Hopkins University

HUGH W. TALBOT
Instructor in Preparatory Science and Mathematics.
B. S., Colgate University.

E. ESTELLE CARRIER
Instructor in Modern Languages and History
Ph. B., Cornell College.

WILLIAM A. COURSEN
Superintendent of Buildings and Grounds and Instructor in Machine Shop

DELLA MAY HAFT
Librarian
Ph. B., University of Chicago.

BERTHA MORRIS
Registrar and Secretary to the President.

Other Employees

ARTHUR THIEL, Student Assistant in Chemistry.
CLYDE E. GATES, Student Assistant in Chemistry.
B. M. O'HARRA, Student Assistant in Metallurgy.
ELWYN SMITH, Student Assistant in Physics.
MRS. A. O. ANDERSON, Janitor
FRANK BOYD, Fireman

E. J. ALLMENDINGER, Football Coach.
ARTHUR W. FAHRENWALD, Baseball Coach.

Standing Committees of the Faculty

Committee on Admission and Registration:

PROFESSOR VAN NUYS, Chairman
PROFESSOR STEELE
PROFESSOR McLEARIE
PROFESSOR DUNN

Committee on Emergencies:

PROFESSOR VAN NUYS, Chairman
PROFESSOR McLAURY
PROFESSOR McLEARIE
PROFESSOR RUNNER
PROFESSOR CROOK

Committee on Student Welfare:

PROFESSOR RUNNER, Chairman
PROFESSOR VAN NUYS
PROFESSOR STEELE
MRS. CARRIER
MR. TALBOT

Committee on Theses and Degrees:

PROFESSOR CROOK, Chairman
PROFESSOR SMITH
PROFESSOR DUNN
PROFESSOR McLAURY

Committee on Athletics:

PROFESSOR RUNNER, Chairman
PROFESSOR McLEARIE
PROFESSOR DUNN

Committee on School Magazine:

PROFESSOR McLEARIE, Chairman
PROFESSOR SMITH
PROFESSOR STEELE
PROFESSOR CROOK

Committee on Catalog:

PROFESSOR STEELE, Chairman
PROFESSOR McLEARIE

Committee on Library:

MR. TALBOT, Chairman
PROFESSOR DUNN
MISS HAFT

Board of Control of the Athletic Association:

PROFESSOR McLEARIE, Chairman
MR. RODNEY CRAGIN, Secretary
PROFESSOR RUNNER
PRESIDENT O'HARRA
MR. LIONEL E. BOOTH
MR. LEON ANDERSON
DR. CHARLES McDOWELL

PROFESSOR McLAURY, Secretary of the Faculty.

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 P. M.

RAPID CITY, LOOKING NORTHWEST

General Statement

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part by the state as state institutions.

The following is an extract from the act of the legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible,

the school also aids the development of the mineral resources of the state by the investigation of mining and metallurgical problems which arise. At the present time, many graduates of the School are employed in responsible positions in the Black Hills and throughout the West generally, and are doing much toward the development of the state's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting and to cyanidation.

Recent demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this school, together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. These may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratory, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that purpose. In 1903 $18,000 was appropriated by the legislature for a rear addition and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metal-

lurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the Preparatory Building, $2,500 for replacements in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment, at the present time, is such as to give good facilities for thorough instruction in mining and metallurgy, and allied subjects.

Location.

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of an equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit with its particular and sometimes striking color yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills with its bold pinnacles and shoulders of coarse, bare granite rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque

that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately somber forms of porphyry buttes, there is presented a view well worth many hardships to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock-raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The total mineral production since the first mining in 1875 is approximately $190,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the

Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 4,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid Creek 3200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction

liable to result where the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but, to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses

The School of Mines has from the early days of its organization maintained classes in various branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give extended courses in these subjects. The Regents of Education have authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In conformity with this authorization a four years course in Electrical Engineering and a four years course in Civil Engineering have been outlined and the first three years of each of these courses will be offered during the coming year. In the purchase of apparatus for teaching these engineering courses, efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In civil engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the

various phases of mining and municipal problems. In electrical engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Four hydro electric plants on as many different mountain streams of the Black Hills and costing approximately two million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which students found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped

mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Engineering. The chemical laboratories comprise the general, qualitative, and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The Department of Civil Engineering consists of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop. The machine shop enables the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories high, built of red brick covered with stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horsepower of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A

RELIEF MAP OF THE BLACK HILLS

THE
JOHN CREERAR
LIBRARY

third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

Equipment

In general, the school is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

Library

The library and reading room occupies a large, well lighted and well equipped room on the first floor of the Main building. Here are found the standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Economics, and many works of a general nature.

Authoritative scientific journals published in the United States, Canada, Mexico, England and Germany are found on the reading tables and are bound when volumes are completed—putting in substantial form the latest research in the sciences taught in this school. Some of these sets are complete, such as the *American Journal of Science,* consisting of one hundred eighty-two volumes; *Journal of Geology,* nineteen volumes; *Journal of Society of Chemical Industry,* thirty volumes. Others, such as *Engineering and Mining Journal, Mining and Scientific Press, Mines and Minerals,* are nearly complete and are being completed as rapidly as possible.

The publication of the learned societies of the United States and England are represented by Proceedings of the Royal Society of London, of the Institution of Mining and Metallurgy, of the Institution of Mining Engineers, of the Iron and Steel

Institute and of the American Institute of Mining Engineers.

The library is the repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

The Dewey system of classification is used and a card index gives author, title and subject.

The privileges of the Library are extended to those not attending the college who may find use for its books of reference.

Drawing Rooms

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories

There are three chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, and one for quantitative analysis. The last two laboratories are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate balance room in which are analytical balances of standard makes, among them Becker's and Troemner's. There is also a

private laboratory for the professor of Chemistry.

The apparatus is ample for all mineral, alloy and rock analysis, and includes combustion furnaces, apparatus for gas analysis, facilities for electrolytic precipitations, calorimeters for fuel analysis and spectroscopes for qualitative experiments.

Biological Laboratory

The equipment in this laboratory is modern and suitable for bacteriological, zoological and botanical purposes. A large Alberene stone aquarium containing aquatic plants and animals is maintained to show their interrelations and habits of growth and reproduction. We have excellent charts and slides which greatly aid in the study of living material. Compound and dissection microscopes are used throughout the work. Our large herbarium and a collection of representative animal forms are used to great advantage in obtaining interest and proficiency.

Physical Laboratory

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, reciprocating and mercury air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for calorimetric determinations of specific heat by the method of mixtures, Waterman's method, Bunsen's method, or the cooling method, Mahler-bomb calorimeter

for heat of combustion, latent heat of vaporization, etc., Dalton's apparatus, complete apparatus for the determination of the mechanical equivalent of heat, Regnault's apparatus; seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds and Northrup, and Cambridge Scientific Instrument Company's galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltameters, fluxmeters, permeameters, Woulff precision resistances; also completely equipped switch-boards for both high and low voltage distribution of direct or one, two or three phase alternating current, made by Max Kohl of Germany, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; a variety of dynamos, motors, motor-generator set, induction machines, gasoline engines, and models of steam and gas engines.

The School also possesses a completely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two, or three

phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound rotor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smallerA.C. and D. C. motors of various types. In addition to the above, the School heating and lighting plant and the equipment of the Department of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, two Gurley transits, one with solar attachment, one Keuffel and Esser transit with Saegmuller attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, levelling rods, range

poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fire-proof. There is a melting furnace using coke, and gasoline furnaces made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace pro-

ducts, such as matte, flue dust, fume, and umpire samples for close checking work.

Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 19 and 21, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance, pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead, and is best adapted to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. 0 Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filteration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ in. centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors

for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The smelting machinery consists of a 30 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with six metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat treatments and for metallography.

Mineralogical Laboratory

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department upon the payment of a small fee. Each student has his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum

This museum is an important feature in the equipment of the School of Mines. Its contents

have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique rock section of the Homestake mine, donated by the Homestake Mining Company of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards of hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The school is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops

In the basement of the Main Building a small machine shop is provided, containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for the design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the

upper classes are granted permision to use the facilities afforded by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department, a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Ten have been published. They are as follows:

Bulletin No. 1.—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. (*Out of Print*).

By F. R. Carpenter and H. O. Hofman.

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3.—Cyanide Experiments on the Silicious Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4.—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. (*Out of Print*). By C. C. O'Harra.

Bulletin No. 5.—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. (*Out of Print*).

Bulletin No. 6.—The Mineral Wealth of the

Black Hills; 88 pages. 1902. (*Out of Print*). By C. C. O'Harra.

Bulletin No. 7.—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8.—The Cement Resources of the Black Hills. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr. and C. H. Fulton.

Bulletin No. 9.—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. (*Out of Print*).

Bulletin No. 10.—The Minerals of the Black Hills, 200 pages. 1914. By Victor Zeigler.

The Pahasapa Quarterly. This is a magazine published by the students with the assistance and general supervision of the faculty. As its name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

STUDENTS' EXPENSES

Tuition

The tuition and incidental fee is $6 per semester, or $12 per year, *payable in advance on registration.* This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire

with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees and Deposits.

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 11-12, Qualitative Analysis, per semester	$ 5.00
Chemistry 17-18, Quantitative Analysis, per semester	6.00
Chemistry 21-22, Metallurgical Analysis, per semester	6.00
Metallurgy 19-21, Metallurgical Laboratory, per semester	5.00
Metallurgy 23, Cyanide Testing, per semester	5.00
Metallurgy 24, Assaying, per semester	5.00
Students' Activities Fee, required of all regularly enrolled students, per semester	3.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Fee for permit for "conditioned" examination	2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named. The unused portion of each deposit will be returned to the student at the end of each semester.

Metallurgy 23, Cyanide Testing, deposit	$20.00
Metallurgy 24, Assaying, deposit	20.00
General breakage deposit for engineering students taking laboratory courses in Chemistry or Metallurgy	5.00

No platinum is furnished by the Department of Chemistry.

Other Expenses of the Nature of Fees

The Department of Engineering furnishes sup-

plies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $4.50 upwards per week. This makes the expense for board and room for the school year of 35 weeks range from $160 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books

Freshman year	$13.00
Sophomore year	17.00
Junior year	20.00
Senior year	19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshman year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this

purpose should be added according to individual taste.

Incidental Expenses

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshman year usually costs the student about $10. The surveying trip in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

Athletic Association

The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basketball teams, and track

athletics. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits. The Students' Activities Fee gives access to athletic grounds and pays for admission to games and for subscription to the Pahasapa Quarterly.

Conduct

The school has no codified rules of conduct. Students are held to a strict account of their work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

Determination of Minerals and Assaying

Minerals are determined free of charge. Assays for gold and silver, etc., and chemical analyses both quantitative and qualitative, are made at reasonable rates. Prices will be sent upon application. All samples for analysis or assay and letters accompanying same should be addressed to the President of the School.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fourteen units are necessary for entrance.

Required Units

Arithmetic	1 unit
Algebra	1.5 units
Plane Geometry	1 unit
Solid Geometry	0.5 unit
English	2 units
History	1 unit

Physics	1	unit
Chemistry	1	unit
Total required units	9	units

Elective Units

German	1, 2 or 3	units
French	1, 2 or 3	units
Latin	2, 3 or 4	units
Greek	1	unit
Spanish	1 or 2	units
English	1 or 2	units
History	1 or 2	units
Mathematics	0.5	unit
Science	1 or 2	units
Drawing	1	unit
Shop Work	1	unit
Civil Government	0.5	unit
Bookkeeping	1	unit
Elective units required for entrance	5	units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School

First: By Certificate. Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Second: By Examination. All other candidates for admission to the regular engineering courses will be required to pass entrance examinations in the subjects specified. These examinations are held at Rapid City on dates mentioned in the calendar. Students who are deficient in subjects required for entrance into the regular engineering courses are permitted to enter the Preparatory Department, maintained by the school for the special purpose of preparing students so deficient.

Credentials for entrance should be in the hands

of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units

Mathematics: The four and one-half units which may be offered in mathematics are as follows:

Arithmetic—One unit, complete, including the metric system.

Algebra—One and one-half units. The equivalent of A, B and C Algebra described under Preparatory Mathematics in the Preparatory Catalog.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Two units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Catalog.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Catalog.

History—One unit. The History of the United States, English or Ancient History, as described under History, in the Preparatory Catalog.

Elective Units

The equivalent of courses, not mentioned above, described under Mathematics, (Trigonometry only), Languages, History, English and Preparatory Science, in the Preparatory Catalog.

Special Students

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

Short Course

A Short Course, of six weeks duration, is offered each year, beginning with the assembling of school after the Christmas vacation. This course is designed for prospectors and miners and other men of maturity who have had practical experience but who have had no opportunity to acquire a technical education. For such men the school offers, during the midwinter weeks, an opportunity to gain some insight into those principles of their work which practice alone will not provide. Instruction is given in the following subjects: Assaying, Cyaniding, Chemistry, Mineralogy, Geology, Ore Dressing and Mining Law. The tuition fee, payable at time of registration, will be six dollars plus the cost of such materials as may be used up in the laboratories.

A feature of interest is that men having ores or minerals of their own will be given opportunity to make tests upon them in so far as such can be done without interfering with the other work of the institution. Every effort will be put forth to make this work both practical and helpful. No credit toward a degree will be given for work pursued in this course.

Summer School

The summer school in surveying begins immediately after commencement and occurs between the sophomore and junior years. The electrical engineers spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mining surveying, and the students in civil engineering spend six weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mining surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Preparatory Department

The School of Mines finds it necessary to maintain a Preparatory Science Course on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which

they have completed and which form part of the curriculum of the School of Mines. The faculty decides these cases upon the basis of individual merit.

Degrees

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineer's degree should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Pre-

paratory department will receive a certificate to that effect.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree. This thesis will be assigned to the individual members of the Senior class by a special thesis committee of the faculty. The standard form of thesis shall be the working out of plans for the development of an hypothetical mine, such subject to be assigned to all students except that the thesis committee may vary the subject as its judgment dictates. Report of progress in thesis work must be made at stated intervals to the theses committee. Theses must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning theses are fully satisfied.

The following is a list of the theses submitted since 1903:

1904. Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

1905. Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

1906. Coolidge, E. B., and Gains, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

1907. Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines Including Metallurgical Treatment

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on the Coolgarde Group of Claims, Ida Gray Mining District.

1908. Coolidge, Cyril and Overpeck, Lem. S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

1909. Betterton, J. O. The Determination and Separation of Antimony and Arsenic.
Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.
Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.
Ledyard, L. W. The Cleopatra Mine.

1910. Eddy, John W., and Bennett, R. T. A Hypothetical Mine.
Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.
Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.
Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of its Ore.
Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

1911. Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.
Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.
Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.
Quinney, E. H., and Windsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.
Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

1912. Dickey, S. C., and Mosier, P. M. Preliminary Treatment in the Concentration of an Argentiferous Copper Ore.
Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

1913. Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.
Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.
Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

1914. Bochert, W. C. Metallurgical Treatment of A Typical Refractory Siliceous Ore.
Eldredge, Robert B. Experiments in Ore Flotation.
Fahrenwald, Arthur W. Report on the Metallurgical Investigation of A Blue Ore.
Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.
Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.
Hill, Robert S. Notes on Beryllium.
McCauley, Willard J. An Investigation of the Irrigation Possibilities of Little Elk Creek.
Meents, R. O. Leaching A Copper Ore.
Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.
Stowell, George E. The Geology of Silver City and Vicinity.

1915. Booth, L. E. and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulphocyanide.
Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.
O'Harra, B. M. The Gold-bearing Quartz-Tremolite Series of the Black Hills.

COURSES AND DEPARTMENTS

The courses given by the School of Mines are:

Mining Engineering Course .....4 years
Metallurgical Engineering Course .....4 years
Civil Engineering Course .....4 years
Electrical Engineering Course .....4 years

SYNOPSIS OF COURSES

Mining Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9, 11—Qualitative analysis	32	144
Geology 1—General geology	64	48
Civil Engin. 1—Mechanical drawing.		96
English 9—Composition	64	
Mathematics 11—Algebra	32	
	320	288
Hours per week	20	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	80	
Chemistry 6, 8—General chemistry	48	48
Chemistry 10,12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Civil Engin. 2—Mechanical drawing.		96
English 10—Composition	64	
Mathematics 12—Algebra	32	
	304	288
Hours per week	19	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry	32	
Chemistry 15,17–Quantitative analysis	32	96
Mineralogy 1—General mineralogy	32	96
Civil Engin. 3—Descriptive geometry		96
Civil Engin. 5—Surveying	48	48
	224	336
Hours per week	14	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	

Chemistry 16, 18–Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis ...	32	96
Civil Engin. 4—Descriptive geometry		48
Civil Engin. 6—Surveying	48	48
Metallurgy 2—General metallurgy ..	48	
	272	336
Hours per week	17	21

Summer surveying, three weeks.

Third Year

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	
Geology 3—Petrology	48	96
Civil Engin. 7—Topographic drawing		24
Civil Engin. 9—Machine design		96
Civil Engin. 11—Graphics		24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	288	336
Hours per week	18	21

Second Semester—	Lectures	Lab.
Physics 6, 8—General physics	64	96
Civil Engin. 14—Mechanics of materials	64	
Geology 4—Physical Geology	48	
Economics	48	
Metallurgy 24—Assaying	32	144
Civil Engin. 12—Graphics		48
Mining 6—Tunneling, shaft sinking .	48	
	304	288
Hours per week	19	18

Fourth Year

First Semester—	Lectures	Lab.
Elect. Engin. 3—General electrical engineering	64	48
Geology 5—Economic geology	64	

Mining 7—Drainage, transportation..	32	
Mining 9—Shaft sinking, exploitation	48	
Metallurgy 5—Gold and silver	48	
Metallurgy 9—Copper and lead	32	
Mining 11—Mine design		96
Mining 13—Mining Law	16	
Metallurgy 19—Laboratory		48
Thesis		48
	304	240
Hours per week	19	15

Second Semester—	Lectures	Lab.
Physics 14—Thermodynamics	32	
Physics 12—Hydraulics	32	24
Geology 6—Economic geology	64	
Mining 8—Compressed air	32	
Mining 10—Ventilation and lighting, placer mining	48	
Metallurgy 6—Iron and steel	32	
Civil Engin. 20—Power plants	32	24
Mining 12—Mine designing		96
Mining 14—Mine accounting		32
Metallurgy 20—Mill run		48
Thesis		96
	272	320
Hours per week	17	20

Metallurgical Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5—General chemistry	48	
Chemistry 9,11—Qualitative analysis.	32	144
Geology 1—General geology	64	48
Civil Engin. 1—Mechanical drawing .		96
English 9—Composition	64	
Mathematics 11—Algebra	32	
	320	288
Hours per week	20	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry ..	80	
Chemistry 6, 8—General chemistry ..	48	48
Chemistry 10, 12—Qualitative analysis	16	96
Geology 2—General geology	64	48
Civil Engin. 2—Mechanical drawing.		96
English 10—Composition	64	
Mathematics 12—Algebra	32	
	304	288
Hours per week	19	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry..	32	
Chemistry 15, 17—Quantitative analysis	32	96
Mineralogy 1—General mineralogy ..	32	96
Civil Engin. 3—Descriptive geometry		96
Civil Engin. 5—Surveying	48	48
	224	336
Hours per week	14	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry.	32	
Chemistry 16, 18—Quantitative analysis	32	144
Mineralogy 2—Blow-pipe analysis ...	32	96
Civil Engin. 4—Descriptive geometry		48
Civil Engin. 6—Surveying	48	48
Metallurgy 4—General metallurgy ...	80	
	304	336
Hours per week	19	21

Summer surveying three weeks.

Third Year

First Semester—	Lectures	Lab.
Physics 5, 7—General physics	64	48
Physics 9—Analytic mechanics	64	

Chemistry 19, 21—Quantitative analysis	48	96
Civil Engin. 7—Topographic drawing		24
Civil Engin. 9—Machine design		96
Civil Engin. 11—Graphics		24
Mining 1, 3—Ore dressing	64	48
Mining 5—Boring, breaking ground, explosives	48	
	288	336
Hours per week	18	21

Second Semester—	Lectures	Lab.
Physics 6,8—General physics	64	96
Civil Engin. 14—Mechanics of materials	64	
Chemistry 20, 22—Quantitative analysis	16	32
Economics	48	
Metallurgy 24—Assaying	32	144
Civil Engin. 12—Graphics		48
Mining 6—Tunneling, shaft sinking	48	
	272	320
Hours per week	17	20

Fourth Year

First Semester—	Lectures	Lab.
Elect. Engin. 3—General electrical engineering	64	48
Metallurgy 5—Gold and silver	48	
Metallurgy 7—Gold and silver	32	
Metallurgy 11—Copper and lead	80	
Metallurgy 13—Metallurgical calculations	16	
Metallurgy 21—Metallurgical laboratory		96
Mining 13—Mining law	16	
Mining 7—Drainage, transportation	32	
Metallurgy 23—Laboratory		144
Thesis		48
	288	336
Hours per week	18	21

Second Semester—	Lectures	Lab.
Physics 14—Thermodynamics	32	
Physics 12—Hydraulics	32	24
Civil Engin. 20—Power plants	32	24
Metallurgy 8—Gold and silver	16	
Metallurgy 6—Iron and steel	32	
Mining 14—Mining accounting		32
Metallurgy 18—Metallurgical design		96
Metallurgy 20—Mill run		48
Metallurgy 10—Electrometallurgy	32	
Metallurgy 12—Zinc and minor metals	32	
Metallurgy 14—Metallurgical calculations	16	
Mining 8—Compressed air	32	
Thesis		96
	256	320
Hours per week	16	20

Civil Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5, 7—General and analytical chemistry	48	96
Geology 1—General geology	64	48
English 9—Composition	64	
Mathematics 11—Advanced algebra	32	
Civil Engin. 1A—Mechanical drawing		144
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Mathematics 8—Analytical geometry	80	
Chemistry 6, 8A—Gen. and analytical chemistry	48	96
Geology 2—General geology	64	48
English 10——Composition	64	
Mathematics 12—Advanced algebra	32	
Civil Engin. 2A—Mechanical drawing		144
	288	288
Hours per week	18	18

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial Chemistry	32	
Mineralogy 1A—General mineralogy	32	48
Civil Engin. 5A—Surveying	80	96
Physics 5, 7—General physics	64	48
Civil Engin. 3—Descriptive geometry		96
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	
Civil Engin. 8—Astronomy	32	48
Civil Engin. 6A—Surveying	80	96
Physics 6, 8—General physics	64	48
Civil Engin. 4A—Descriptive geometry		96
	288	288
Hours per week	18	18

Summer Surveying, six weeks.

Third Year

First Semester—	Lectures	Lab.
Physics 9—Analytic Mechanics	64	
Civil Engin. 13—Railroad Engineering	64	
Civil Engin. 7A—Topographic drawing		96
Civil Engin. 11A—Graphics		48
Metallurgy—Iron and Steel	32	
Mathematics—Least squares	16	
Civil Engin. 9—Machine design		96
Mining 5—Excavations	48	
Sociology	48	
	272	240
Hours per week	17	15

Second Semester—	Lectures	Lab.
Civil Engin. 14A—Mechanics of Materials	80	
Civil Engin. 16—Testing Materials	32	96
Mining 6—Tunneling	48	
Civil Engin. 12—Graphics		48
Civil Engin. 18—Stereotomy		96
Civil Engin. 22—Cement and Concrete	32	
Civil Engin. 20—Power plants	32	48
Economics	48	
	272	288
Hours per week	17	18

Fourth Year

First Semester—	Lectures	Lab.
Civil Engin. 23—Roofs and Bridges	80	96
Elect. Engin. 3—Electrical engineering	64	48
Civil Engin. 25—Dams and Retaining Walls	48	
Civil Engin. 27—Arches, Masonry and Foundations	48	48
Civil Engin. 29—Roads and Pavements	48	
Thesis		96
	288	288
Hours per week	18	18

Second Semester—	Lectures	Lab.
Civil Engin. 24—Roofs and Bridges	48	96
Physics 12—Hydraulics	64	48
Civil Engin. 26—Sewers	32	
Civil Engin. 28—Contracts and Specifications	16	
Civil Engin. 30—Irrigation, Water Power and Supply	80	
Civil Engin. 32—Framed Structures	48	48
Thesis		96
	288	288
Hours per week	18	18

Electrical Engineering Course

First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	80	
Chemistry 5, 7—Gen. and analytical chemistry	80	96
English 9—Composition	64	
Civil Engin. 1—Mechanical drawing		96
Shop Work 5—Pattern making		96
Elect. Engin 1—Elementary	32	48
Mathematics 11—Advanced algebra	32	
	288	336
Hours per week	18	21

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	80	
Chemistry 6, 8A—General and analytical chemistry	48	96
English 10—Composition	64	
Civil Engin. 2—Mechanical drawing		96
Shop Work 6—Machine work		96
Elect. Engin. 2—Elementary	32	48
Mathematics 12—Advanced algebra	32	
	256	336
Hours per week	16	21

Second Year

First Semester—	Lectures	Lab.
Mathematics 9—Calculus	80	
Chemistry 13—Industrial chemistry	32	
Civil Engin. 5—Surveying	48	48
Civil Engin. 9—Machine Design		96
Civil Engin. 3—Descriptive geometry		48
Physics 5, 7—General physics	64	48
	224	240
Hours per week	14	15

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	80	
Chemistry 14—Industrial chemistry	32	

Civil Engin. 6E—Surveying	24	48
Civil Engin. 12—Graphics		48
Civil Engin. 4—Descriptive geometry		96
Physics 6. 8—General physics	64	96
	200	288
Hours per week	12½	18

Summer surveying, two weeks.

Third Year

First Semester—	Lectures	Lab.
Mathematics 13—Differential equations	48	
Physics 9—Analytic mechanics	64	
Electrical Engineering 3—General	64	48
Elect. Engin. 5—Elect. Measurements		96
Elect. Engin. 7—Electrical design		96
Physics 11–Light and electrical theory	32	48
Sociology	48	
	256	288
Hours per week	16	18

Second Semester—	Lectures	Lab.
Physics 12—Hydraulics	32	24
Physics 14—Thermodynamics	32	
Civil Engin. 20—Power plants	32	48
Civil Engin. 14—Mechanics of materials	64	
Economics	48	
Metallurgy—General metallurgy	48	
Elect. Engin. 8—Alternating Current Laboratory		48
Elect. Engin. 6—Electrical measurements		48
Civil Engin. 16—Testing Laboratory		48
Shop Work 8—Winding Laboratory		48
	256	264
Hours per week	16	16½

Fourth Year

First Semester—	Lectures	Lab.
Elect. Engin. 15—A. C. Theory	48	
Electrometallurgy	32	
Elect. Engin. 9—Distribution and Control	48	
Electrochemistry	48	
Elect. Engin. 11—Alternating Current Machinery	64	
Elect. Engin. 13–Electrical Laboratory		96
Electrical Design		96
Thesis		96
	240	288
Hours per week	15	18

Second Semester—	Lectures	Lab.
Elect. Engin. 12–Hydro-electric plants	48	
Elect. Engin. 16—Telegraphy and telephony	32	
Elect. Engin. 18—Electric Railways	48	
Elect. Engin. 20—Steam-electric plants	32	
Elect. Engin. 22—Illumination	32	
Elect. Engin. 24—Elect. management	48	
Elect. Engin. 14—Elect. Laboratory		96
Electrical Design		96
Thesis		96
	240	288
Hours per week	15	18

Preparatory Science Course

First Year

First Semester—	Lectures	Lab.
Mathematics 1—Algebra	5	
English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient history	5	
Shop Work 1—Wood Shop		6
	18	9

Second Semester—	Lectures	Lab.
Mathematics 2—Algebra	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediaeval history	5	
Shop Work 2—Wood Shop		6
	18	9

Second Year

First Semester—	Lectures	Lab.
Mathematics 3—Geometry	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Shop Work 3—Forging		3
	18	6

Second Semester—	Lectures	Lab.
Mathematics 4—Geometry	5	
English 4—Rhetoric	5	
History 4—U. S. history	5	
Biology 4—Botany	3	3
Shop Work 4—Molding and casting		3
	18	6

Third Year

First Semester—	Lectures	Lab.
French 1 or Spanish 1	5	
German 1	5	
Biology 5—Zoology	3	6
English 5 or 7—English or American Literature	5	
Freehand Drawing		3
	18	9

Second Semester—	Lectures	Lab.
French 2 or Spanish 2	5	
German 2	5	
Astronomy	3	3

English 6 or 8—English or American Literature	5	
Physical Geography	3	3
Freehand Drawing		3
	21	9

Fourth Year

First Semester—	Lectures	Lab.
Chemistry 1-3	3	6
German 3 or French 3 or Spanish 3	5	
Physics 1-3	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures	Lab.
Chemistry 2-4	3	6
German 4 or 6 or French 4 or Spanish 4	5	
Physics 2-4	4	6
Mathematics 6—Algebra	5	
	17	12

Department of Geology and Mineralogy

PROFESSOR O'HARRA PROFESSOR RUNNER

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizans, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, endesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and

limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2

PROFESSOR RUNNER

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physi-

cal history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year: Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Chamberlain and Salisbury's College Geology.

Mineralogy 1.

PROFESSOR RUNNER

Crystallography: Eight weeks are given to the study of the symmetry, forms and classification of crystals. In the laboratory the student becomes familiar with the various types of crystals through the study of models and later is required to identify the forms of one hundred mineral crystals.

Physical Mineralogy: The remainder of the semester is devoted to the physical properties of minerals in general and the composition, forms, properties, occurence, association, origin and uses of one hundred of the more common minerals are studied in detail. In the laboratory seven hundred unlabeled specimens of the minerals discussed in the class room are determined from their physical properties alone. The course is planned to develop such information as may be needed for the quick and accurate determination of minerals in the field.

Sophomore Year, First Semester. Two lecture periods and six laboratory hours per week. Text: Rogers' Study of Minerals.

Mineralogy 1A.

PROFESSOR RUNNER.

General Mineralogy. This course is similar to

Mineralogy 1, but the laboratory work is modified for students taking Civil Engineering.

Sophomore year, First Semester. Two lecture periods and three laboratory hours per week. Text as above.

Mineralogy 2.

PROFESSOR RUNNER.

General Mineralogy and Blow Pipe Analysis: The chemical properties and relations of minerals and the methods of blow pipe and other chemical analyses for their determination are first studied, after which the chemical and physical properties, origin, associations and uses of about one hundred mineral species are taken up, special emphasis being paid to ore and common rock forming minerals. The laboratory work consists of the determination of approximately one thousand four hundred unlabelled specimens of minerals by means of chemical tests and physical properties. A detailed report of all results obtained is made out and kept for reference. It is expected that upon completion of this and the preceding course the student will have gained a good working knowledge of over two hundred of the common minerals including the chief factors of their distribution, uses, value and output.

Sophomore Year, Second Semester. Two lecture periods and six laboratory hours per week.

Texts: Rogers' Study of Minerals. Lewis' Determinative Minerals.

Geology 3

PROFESSOR RUNNER

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts,

optical signs and indicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rock, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Zirkel and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence, and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, First Semester, Mining Engineering option: Three lecture periods and six laboratory hours per week.

Reference books: Manual of Petrographic

Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and their origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 4

PROFESSOR RUNNER

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations is next taken up followed by a brief summary of the modern ideas on diastrophism and isostacy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Junior Year, Second Semester, Mining Engineering option. Three lecture periods per week.

Text: Leith's Structural Geology. Lecture notes.

Geology 5-6

PROFESSOR O'HARRA

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays , cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mer-

cury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology of the United States; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits.

Department of Mining

PROFESSOR DUNN

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valued assets.

The following courses are offered by the department:

Mining 1-3

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Four lecture periods and three laboratory hours per week.

Mining 5

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed;

pointing and charging of holes; methods of firing; cost of blasting operations.

Junior, First Semester: Three lecture periods per week.

Mining 6.

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Junior Year, Second Semester: Three lecture periods per week.

Mining 7.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tram ways and aerial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 8

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 9

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester: Three lecture periods per week. Mining Engineering Option.

Mining 10.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging; costs and results.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 11-12.

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine,

makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 13.

MR. C. L. LEWIS

Mining Law: During the year Judge C L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate, the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, First Semester: One lecture period per week for twelve weeks.

Mining 14.

PROFESSOR DUNN

Mine Examination: Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties; forms of report.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; dis-

cussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Senior Year, Second Semester: Two lecture periods per week.

Department of Civil Engineering

PROFESSOR STEELE

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position, and to teach him so much of the underlying theory and principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture room and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Civil Engineering 1-2

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometic and cabinet projection, machine details, and both free hand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6 in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers,
One 5½ in. ruling pen,
One 3½ in. steel spring bow divider,
One 3½ in. steel spring bow pencil,
One 3½ in. steel spring bow pen,
One T square with 30 in. blade,
One 4½ in. protractor,
One irregular curve,
One 7 in. 30° by 60° triangle,
One 8 in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Civil Engineering 1A-2A

Mechanical Drawing: Similar to Civil Engineering 1-2, but nine hours per week during the Freshman Year. Isometric and oblique projection and structural drawing will be given special attention. A small amount of time will be devoted to architectural drawing.

Civil Engineering 3-4

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Civil Engineering 4A

Descriptive Geometry: Similar to Civil Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six laboratory hours per week.

Civil Engineering 5-6

Surveying. Plane Surveying. It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the con-

ditions will permit. Trigonometry is a prerequisite.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year: Three lecture periods and three hours field work per week during the year.

A three week's summer school for practical work immediately follows the close of school in June. It includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Johnson's Theory and Practice of Surveying.

Civil Engineering 5A-6A.

Surveying: Course similar to Civil Engineering 5-6, but amplified for Civil Engineering students. In addition to the subjects mentioned under the preceeding course, this course treats of geodetic surveying including base line measurement, triangulation and measurement of angles, trigonometric and precise levelling and map projection.

Five hours lectures and six hours field work per week during the Sophomore year, followed by six weeks summer field work.

Civil Engineering 6E

Plane Surveying: Same as Plane Surveying under Course 6, but does not include Mine Surveying. Sophomore Year, Electrical Engineering Course, Second Semester. Three hours lectures per week for one half semester; three hours field work per week for one semester, followed by two weeks summer field work.

Civil Engineering 7.

Topographic Drawing: This work embraces the accurate drawing of maps, including topo-

graphic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week for eight weeks.

Civil Engineering 7A.

Topographic Drawing: This course includes the same subjects as Course 7, but the work is amplified for Civil Engineering students. Prerequisite Civil Engineering 5A-6A.

Junior Year, First Semester: Six laboratory hours per week.

Civil Engineering 8

Astronomy: A short course in Field Astronomy for Civil Engineering students, special attention being given to the observations for azimuth, latitude, longitude and time. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second Semester: Two lectures and one evening for observation per week.

Civil Engineering 9.

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. The application to mining machinery is always kept in mind. Drafting room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week.

Civil Engineering 11-11A-12

Graphical Statics: The object of this course

is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amount of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: Three laboratory hours per week. Course 11A-12 extends throughout the year. Course 11-12 extends during eight weeks of the first semester and all of the second semester.

Text book: Hoskins, Elements of Graphic Statics

Civil Engineering 13.

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, road-bed, ballast, bridges, culverts, yards, elevation of outer rail, signals, locomotives, curve and grade problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course. Four lecture hours per week.

Civil Engineering 14

Mechanics of Matreials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Civil Engineering 14A

Mechanics of Materials: This is a somewhat more extended course than the preceding, and is given five lecture hours per week. It includes all the work given in the text book above mentioned.

Junior Year, Second Semester, Civil Engineering course.

Civil Engineering 16

Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14 or 14A.

Junior Year, Second Semester, Civil Engineering Course. Two hours lectures and six hours laboratory work per week.

Civil Engineering 18

Stereotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Six laboratory hours per week.

Civil Engineering 20

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and kerosene engine. This apparatus is also available for laboratory work in this course.

Senior Year, Second Semester: Two lecture periods per week for the semester and three laboratory hours per week for eight weeks.

Civil Engineering 22

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.

Department of Physics and Electrical Engineering

PROFESSOR VAN NUYS

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

Especial attention is given to the general laws underlying the science, and the history of the discovery and development of the important results is considered carefully. In the laboratory courses, the purpose is to excite in the student an interest in experimentation and to develop the ability for careful observation and the testing and sifting of results.

The courses offered by the department are as follows:

Physics 5

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 9. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics.

First Semester: Sophomore Year for Civil and Electrical Engineers, Junior Year for Mining

and Metallurgical Engineers. Four lecture periods per week.

Text Book: Duff's Text Book of Physics.

Physics 6

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, electromagnetism and electromagnetic induction are considered in detail, and a careful study of the theory of electrical measurements is made.

The subject of light is considered from the standpoint of the electro-magnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

Second Semester, as above. Four lecture periods per week.

Physics 7.

Laboratory course to accompany Physics 5. The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity of solids, liquids and gases, acceleration of gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of calorific power of fuels, specific and latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves.

First Semester, as above. Three laboratory hours per week.

Physics 8.

Laboratory course to accompany Physics 6: The equipment for optics and electrical measure-

ments is described on page 19 and is ample for effective work along these lines.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Second Semester, as above. Six laboratory hours per week.

Physics 9.

Analytic Mechanics: The theory is developed by lectures. Many problems will be solved to enforce the principles and to develop ability in the student to apply what he has learned to practical problems. Particular effort is made to cultivate the power of the student to use calculus methods when needed. The course includes the following subjects:

Statics: First principles; units, composition and resolution of concurring forces; composition and resolution of forces acting on a rigid body; conditions of equilibrium center of gravity; friction, virtual velocities; machines; the funicular polygon and the catenary.

Kinematics: Rectilinear and curvilinear motion; composition and resolution of acceleration; angular velocity and angular acceleration; projectiles, etc.

Kinetics: Laws of motion; motion under the action of a variable force; motion in a resisting medium; constrained motion; the simple pendulum; centripetal and centrifugal forces. Impact; work and energy; moment of inertia.

Junior Year, First Semester: Four lecture periods per week.

Physics 11.

Electromagnetic theory of light and theory of electrons. Junior Year, First Semester, Electrical Engineering Course. Two lecture periods and three laboratory hours per week.

Physics 12.

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 5, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for weir and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Four lecture periods and three laboratory hours per week for eight weeks.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Physics 14.

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Senior Year, Second Semester: Four lecture periods per week for eight weeks.

Electrical Engineering 1-2

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Freshman Year, Electrical Engineering course. Two hours lectures and three hours laboratory per week.

Electrical Engineering 3.

This course deals with the principles and general construction of dynamo-electric machinery; systems of direct current distribution; direct current motors, their action, control and application; the principles and general construction of alternating and polyphase dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments in the operation and testing of direct and alternating current generators, motors. and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of all other courses: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Franklin & Esty, Elements of Electrical Engineering, 2 Vols.

Electrical Engineering 5-6.

Electrical Measurements: Junior Year Electrical Engineering Course. Six laboratory hours per week during the first semester and three laboratory hours per week during the second semester.

Electrical Engineering 7.

Electrical Design: Drafting room work. The mechanical design of direct current generators and motors, alternating current generators and synchronous and induction motors.

Junior Year, Electrical Engineering Course, First Semester: Six laboratory hours per week.

Electrical Engineering 8

Alternating Current Laboratory, Junior Year, Second Semester, Electrical Engineering Course: Three laboratory hours per week.

Department of Chemistry

PROFESSOR COOLBAUGH

The courses in chemistry are designed to give to mining and to metallurgical engineers the knowledge of chemistry most essential to their work. Especial emphasis is given to the laws underlying the science; the separations, estimations, etc., being made with these principles in mind. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation, and to teach the proper correlation of the results of experiments.

Chemistry 5-6.

General Chemistry: Lectures. This course is designed to give to the student a knowledge of the principal theories and laws of the science. The following subjects are discussed in an elementary way: Atoms and molecules, gases, liquids, solids, solutions, thermo and electro-chemistry and chemical equilibrium. Special attention is given to those portions of the subject bearing upon osmotic pressure, freezing and boiling points of solutions, electrolytic dissociation and the law of mass action. A small amount of time is also given to the consideration of organic chemistry.

Freshman Year: Three lecture periods per week throughout the year.

Reference Books: Newth's Inorganic Chemistry; Ostwald's Principles of Inorganic Chemistry; Jones' Elements of Physical Chemistry.

Chemistry 7.

Laboratory work to accompany Course 5 for

Civil and Electrical Engineering students. Freshman Year, First Semester: Six laboratory hours per week.

Chemistry 8.

General Chemistry Laboratory: Inorganic preparations, the study of crystallization and distillation, the use of indicators, and the effect of mass upon the time and extent of reactions.

Freshman Year: Three laboratory periods per week for the second half year.

Chemistry 8A.

Laboratory work to accompany Course 6 for Civil and Electrical Engineering students. Freshman Year, Second Semester: Six laboratory hours per week.

Chemistry 9-10

Qualitative Analysis: Lectures. The work in qualitative analysis begins with an outline of the general scheme of analysis. Then follows a minute study of the metals and the acid radicals with their detections and separations. Emphasis is placed on the principles of oxidation and reduction, and the theories of ionization and hydrolysis. Separations are made before the class in order to give an idea of the correct use of reagents and of the methods of rapid manipulation.

Freshman Year, First Semester: Two lecture periods per week; second semester, one lecture per week.

Reference Books: Prescott & Johnson's Qualitative Analysis; Treadwell's Qualitative Analysis.

Chemistry 11-12.

Qualitative Analysis: Laboratory. This covers the separation of metals and acids in solutions, dry mixtures, minerals, slags and alloys.

Freshman Year, First Semester: Nine laboratory hours per week; second semester, six laboratory hours per week.

Chemistry 13-14.

Industrial Chemistry: Lectures. The subjects considered in this course are acids, alkalis, sulphur, chlorine, bromine, iodine, cyanides, fertilizers, explosives, bricks, clays, cements, mineral paints, fuel and refractory materials.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Book: Thorp's Outlines of Industrial Chemistry.

Chemistry 15-16.

Quantitative Analysis: Lectures. The work in quantitative analysis consists of discussions of the relative merits of methods applied in the laboratory, the study of articles and reviews from chemical periodicals, and the subject of chemical calculations.

Sophomore Year: Two lecture periods per week throughout the year.

Reference Books: Miller's Quantitative Analysis; Miller's Calculations of Analytical Chemistry; Treadwell's Quantitative Analysis; Sutton's Volumetric Analysis; Low's Technical Methods of Ore Analysis.

Chemistry 17-18

Quantitative Analysis: Laboratory. The course covers the subject of mineral analysis, including both gravimetric and volumetric methods. The analyses required are: Magnesium sulphate, sodium or other chloride, potassium alum, coal, iron ammonium alum, iron ore, pig iron, spiegel or manganese ore, zinc ore, copper ore or matte, brass, lead ore, chromic iron, limestone, arsenic ore, antimony ore, slag, and gas analysis.

Sophomore Year: Nine laboratory hours per week throughout the year.

Chemistry 19-20

Metallurgical Chemistry: Lectures. This

course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. The subjects studied are: The technical methods connected with the metallurgy of iron, steel, zinc, lead and copper; the determinations of bismuth, mercury, cadmium, tin, nickel and the rare elements of commercial importance, and the analysis of electrolytic slimes.

Prerequisites: Chemistry 2, 3 and 4, or equivalents.

Junior Year, First Semester: Three lecture periods per week; second semester, one lecture period per week. Required of Juniors taking the metallurgical option.

Chemistry 21-22.

Quantitative Analysis: Labratory. Work corresponding to Chemistry 19-20.

Junior Year, First Semester: Six hours per week; second semester, two hours per week.

Department of Metallurgy

PROFESSOR CROOK.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 2.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blast; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room, and hand in for examination, papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 19.

Sophomore Year, Mining Engineering Option, Second Semester: Three lecture hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 4.

Introductory Metallurgy: Same course as Metallurgy 2, but amplified by detail.

Sophomore Year, Metallurgical option, Second Semester: Five hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 5.

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the

influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is taken up in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is taken up. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filteration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior Year, both option, First Semester. Three hours per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook.

Metallurgy 6.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, Second Semester: Two hours per week. Lecture notes.

Metallurgy 7-8.

The Metallurgy of Gold and Silver: This course comprises the detailed study of the Cyanide process. It is divided into two parts, the study of the text book and references and the compiling and delivering of lectures on assigned subjects by each of the students in turn. In this way the student becomes thoroughly familiar with the periodical literature as well as the standard books on the subject of cyaniding while preparing his lectures.

Text Book: Clennell, The Cyanide Handbook, References; Julian and Smart, Cyaniding Gold and Silver Ores; McFarren, Cyanide Practice; Volumes of the various technical periodicals.

Senior Year, Metallurgical Option, First Semester: two hours a week. Second Semester one hour a week.

Metallurgy 9.

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and cop-

per ores is taken up, also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining Option, First Semester: Two hours per week.

Reference Works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting; Iles, Lead Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 10.

Electro-Metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, siver, lead, nickel and tin.

Electrothermic processes. Theory. The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc, and for miscellaneous purposses.

Senior Year. Metallurgical Option, Second Semester: Two hours per week.

No text book required. Reference works: Stansfield, The Electric Furnace; Borches, Electric Smelting and Refining.

Metallurgy 11.

The Metallurgy of Copper and Lead: The same as Metallurgy 9, except that it is amplified by detail.

Senior Year, Metallurgical Option, First Semester: Five hours per week.

Text Books: Peters' Practice of Copper Smelting; Hofman's Metallurgy of Lead.

Metallurgy 12.

The Metallurgy of Zinc and the Minor Metals: The roasting of zinc ores; zinc distillation furnaces; the distillation process; the purification of spelter; commercial considerations. The metallurgy of nickel, antimony, tin, bismuth, tungsten and arsenic.

Senior Year, Metallurgical Option, Second Semester: Two hours per week.

No text book required. Reference Works: Ingalls, The Metallurgy of Zinc and Cadmium; Schnabel, Handbook of Metallurgy, Vol. II.

Metallurgy 13-14.

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important calculations in connection with the practice of thermo-chemistry, copper smelting, lead smelting and electro-metallurgy.

Metallurgical Option, Senior Year: One hour per week for both semesters.

Metallurgy 18.

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5-stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Nine laboratory hours per week for the second semester.

Metallurgy 19.

Metallurgical Laboratory: Laboratory practice in pyrometry; calibration of the thermo-couple with use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 20.

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 21.

Metallurgical Laboratory: Course similiar to Metallurgy 19, but amplified.

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 23.

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester: Nine hours per week.

Metallurgy 24.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions occuring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and the excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and

alloy for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Fulton, Manual of Fire Assaying.

Metallurgical Research.

Research Work: Time and fees by arrangement.

Department of Mathematics

PROFESSOR McLAURY

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses.

Mathematics 7.

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book Phillips & Strong's Trigonometry.

Mathematics 8.

Analytic Geometry: This course includes the following subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10.

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11.

Algebra: This course will be a review of Elementary Algebra including logarithms.

Freshman Year, First Semester: Two lecture periods per week.

Mathematics 12.

Algebra: This course will include the following subjects: properties of quadratics, ratio and proportion, variation, progression, indeterminate coefficients, binomial theorem, variables and limits, series, general properties of equations, numerical equations.

Freshman Year, Second Semester: Two lecture periods per week.

Mathematics 13.

Differential Equations, Junior Year. First Semester, Electrical Engineering course: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

Department of English

PROFESSOR McLEARIE

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Steeves and Ristine's Representative Essays in Modern Thought.

English 10 .

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Sociology.

This course is introductory in character. It consists of lectures and required readings on the content and methods of Sociology. The physical, biological and psychological aspects of social evolution will be discussed. As far as posible a number of modern social problems will be considered.

Junior Year, First Semester: Three lecture periods per week.

Economics.

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

Spanish.

To meet the needs of mining engineers and others who go to regions where that language is spoken, an optional course in Spanish is offered.

Four hours per week during the year.

Shop Work

MR. COURSEN.

Shop Work 5.

Pattern Making: Freshman Year. Electrical Engineering Course. First Semester: two afternoons per week. Prerequisites, Shop Work 1, 2, 3, and 4, or the equivalent.

Shop Work 6.

Machine Work: Freshman Year, Electrical Engineering Course. Second Semester: two afternoons per week.

Shop Work 8.

Winding Laboratory: Junior Year, Electrical Engineering Course. Second Semester: one afternoon per week.

List of Students-1914-1915

Graduate Student.

Fahrenwald, Arthur W. B. S. 1914 Rapid City, S. D.

Senior Class.

Booth, Lionel E.....Virginia, Minn.
Gates, Clyde E.....Rapid City, S. D.
O'Harra, B. Marvel.....Rapid City, S. D.
Thiel, Arthur.....Alexandria, S. D.

Junior Class.

Alder, Herbert.....Volin, S. D.
Cragin, Rodney.....Arpan, S. D.
Dennis, Paul.....Hot Springs, S. D.
Hill, Joseph H.....Rapid City, S. D.
Johnson, J. Harlan.....Philadelphia, Pa.
Rugg, Harold H.....Rapid City, S. D.
Smith, Elwyn.....Colorado Springs, Colo.
Wilmarth, John B.....Aberdeen, S. D.

Sophomore Class

Anderson, Leon.....Rapid City, S. D.
Byrne, Francis J.....Pierre, S. D.
Cremer, Frank.....Parkston, S D.
Deutsch, Harry.....Rapid City, S. D.
Holly, Maurice.....Rapid City, S. D.
Lenhart, Walter.....Rapid City, S. D.
Price, Virgil T.....Rapid City, S. D.
Snyder, William E.....Onida, S. D.
Thomas, Lorin.....Rapid City, S. D.
Turner, Frank A.....Faulkton, S. D.

Freshman Class.

Beutner, Adolph.....White Lake, S. D.

Clark, Edwin.....Rapid City, S. D.
Diven, Fane.....Rapid City, S. D.
McKirahan, Samuel.....Rapid City, S. D.
McCain, Galen.....Rapid City, S. D.
Nelson, Harold.....Rapid City, S. D.
Nelson, Oliver.....Rapid City, S. D.
Newbowers, Frank.....Rapid City, S. D.
Norris, Paul.....Haydraw, S. D.
Spencer, Edward.....Newell, S. D.
Tolton, Fay ..... Fort Bennett, S. D.
White, Luther M.....Dressor, Ill.

Special Students

Bentley, Orlando.....Trojan, S. D.
Scanlon, James W.....Hermosa, S. D.
Sherman, Fred.....Maiden, Montana
Watson, James.....Rapid City, S. D.

Preparatory Students.

Anderson, Avery.....Rapid City, S. D.
Bentley, James.....Hot Springs, S. D.
Bentley, Norma.....Hot Springs, S. D.
Biggs, Clifford.....Rapid City, S. D.
Burke, Timon.....Rapid City, S. D.
Blackfox, Benj.....Manderson, S. D.
Blunt, H. L.....Rapid City, S. D.
Buell, Charles, Jr. .....Rapid City, S. D.
Crabtree, Hampton.....Rapid City, S. D.
Crabtree, Verne.....Rapid City, S. D.
Crittendon, Donald.....Rapid City, S. D.
Cordes, Ellsworth W.....Rapid City, S. D.
Curtis, Willard.....Rapid City, S. D.
Harvey, William.....Rapid City, S. D.
Hoffman, Edgar.....Rapid City, S. D.
Hood, Marion.....Rapid City, S. D.
House, Everett.....Rapid City, S. D.
Johnson, Edgar.....Buffalo Gap, S. D.
Karr, Harold.....Hill City, S. D.
Lane Roland.....Rapid City, S. D.
Lintz, James.....Hermosa, S. D.
Lynch, Maurice R.....Rapid City, S. D.
March, Guy.....Hill City, S. D.
March, Raymond.....Hill City, S. D.

Morrison, Edgar.....Caputa, S. D.
Morrison, Floyd C.....Bonita Springs, S. D.
McGee, Gertrude.....Rapid City, S. D.
Newton, Louise.....Rapid City, S. D.
Oleson, George.....Rapid City, S. D.
Oliver, Harold.....Rapid City, S. D.
Platt, Charles.....Caputa, S. D.
Platt, Edward.....Rapid City, S. D.
Perrigo, Harry.....Rapid City, S. D.
Reinbold, Hugo.....San Diego, Calif.
Sands, William.....Rapid City, S. D.
Spencer, Floyd.....Newell, S. D.
Smith, Marion.....Rapid City, S. D.
Soule, Ruth.....Rapid City, S. D.
Todd, Lewis.....Rapid City, S. D.
Tompkins, Emma.....Rapid City, S. D.
Thomas, Walter ..... Rapid City, S. D.
Wasson, Harry.....Keystone, S. D.i
Weeks, Sanford H.....Rapid City, S. D.
Wentzy, Eugenia.....Rapid City, S. D.

Alumni

Eighteen Hundred Eighty-Eight

John W. Hancher, B. S., M. S., South Dakota School of Mines; LL. D., Simpson College; 150 Fifth Avenue, New York, N. Y.

Eighteen Hundred Ninety

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S. Western Representative Gerhard-Mennen Chemical Co., Newark, N. J.

Eva Robinson, B. S., M. A. Professor of Home Economics, University of South Dakota, Vermillion, S. D.

Eighteen Hundred Ninety-One

Mrs. Otillie Behrens Alger, B. S., Custer, S. D.

Nineteen Hundred One

G. Howell Clevenger, B. S., E. M., South Dakota School of Mines; M. A., Columbia University; Associate Professor of Metallurgy, Stanford University, California.

Max Hopkins, B. S. With International Correspondence School of Scranton, Pa. Address, 1415 Majestic Building, Milwaukee, Wis.

Nineteen Hundred Two

Areli C. Overpeck, B. S., E. M. Rapid City, S. D.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four

Samuel S. Arentz, B. S., E. M. Mining Engineer. Dooly Building, Salt Lake City, Utah.

Arthur E. Hall, B. S., M. E., Superintendent Copper Department American Smelting and Refining Co., Omaha, Neb.

Elmer W. West, B. S., M. E. Mining Engineer, Thompson, Nevada.

Guy E. Wolcott, B. S. Mining Engineer, Cripple Creek, Colorado.

Nineteen Hundred Five

O. Allen Anderson, B. S., E. M. Mining Engineer, Saco, Montana.

James Halley, Jr. B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Mine Superintendent, Oliver Iron Mining Co., Virginia, Minn.

Nineteen Hundred Six

Edwin Coolidge, B. S., E. M. Leasing Spotted Horse Mine, Maiden, Mont.

Harry T. Curran, B. S., E. M. Superintendent Argo Reduction Co., Idaho Springs, Colorado

William Gains, B. S. Mill Foreman, Yellow Jacket Mining Co., Salmon City, Idaho.

B. D. O'Brien, E. E. Rose Polytechnic, 1896; B S., E. M., South Dakota School of Mines. Sundance, Wyo.

Louis L. Penhoel, B. S. Assistant Superintendent Montezuma Copper Co., Nacozari, Sonora, Mexico.

J. Burns Read, B. S., E. M. Assistant Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Herbert Seiter, B. S. Mining Engineer, Omaha, Nebr.

Earl Van L. Smith, B. S., Akron, Ohio.

Peter Whytock, B. S. Mining Engineer, Winnemucca, Nevada.

Frederick H. Witherald, B. S., M. E., Aurora, Nevada.

Nineteen Hundred Seven

Frank Anderson, B. S. Engineer, Bisbee, Arizona.
Frank Bryant, B. S., E. M. Leasing Spotted Horse Mine, Maiden, Mont.
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Otto Ellerman, B. S., E. M. State Mine Inspector, Lead, S. D.
Bernard Matson, B. S., U. S. Assay Office, New York, N. Y.
Lloyd Mellinger, B. S. Assayer and Chemist, Eureka, Utah.
Milton Morris, B. S. With New York, Honduras and Rosario Mining Co., San Juancito, Honduras.
C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M. Columbia University. Professor of Physics, South Dakota School of Mines, Rapid City, South Dakota.
Charles Whitmore, B. S. Cashier Lincoln County Bank, Canton, S. D.
Leon Peck Wells, B. S. Vice-president Aberdeen Wholesale Grocery Co., Aberdeen, S. D.

Nineteen Hundred Eight

Cyril Coolidge, B. S. Mining Engineer, Tyrone, New Mexico.
Ivan E. Goodner, B. S. Cyanide Chemist, Aurora, Nevada.
L. L. Hebblethwaite, B. S., Evanston, Ill.
Glen P. Ives, B. S., E. M. General manager, Compani de Minas, Cachiral, Taltal, Chile.
Lem S. Overpeck, B. S. With Frazier and Johnson Commission Co., South Omaha, Nebraska.
Ignacio Diaz Ossa, B. S. President, School of Mines of Serena, La Serena, Chile.
W. G. Sparling, B. S., Rapid City, S. D.
D. C. Woodard, B. S. Assayer and Metallurgist, La Serena, Chile.
Fred W. Winters, B. S., E. M. Lake City, Minn.

Nineteen Hundred Nine

Jesse O. Betterton, B. S., M. E. Assistant Chemist American Smelting and Refining Co., Omaha, Nebraska.

Roy F. Coolidge, B. S., E. M. Mining Engineer, Butte, Montana.

Eli A. Hvistendahl, A. B., University of South Dakota; B. S., South Dakota School of Mines. With American Smelting and Refining Co., Omaha, Neb.

H. W. Jones, A. B., University of South Dakota; B. S., South Dakota School of Mines. Farmer, Vermillion, S. D.

Lewis W. Ledyard, B. S. Mining Engineer, Cobalt, Ontario.

Willard C. Marshall, B. S. With Rapid City Pressed Brick Co., Rapid City, S. D.

Herbert N. Read, B. S., E. M. With Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Ten

Richard T. Bennett, B. S. Electrician, Minneapolis, Minn.

John Wasson Eddy, B. S. Helena, Montana.

John Wing Elliott, B. S., Manager Columbus Auto Company, Columbus, Neb.

George Earl Flower, B. S. Constructing Engineer, Cleveland Water Filtration Station, Cleveland, Ohio. Address 1436 W. 110th St.

Zay Jeffries, B. S., M. E. Instructor in Metallurgy, Case School of Applied Science, Cleveland, O.

Arthur E. Sargeant, B. S. Mill Superintendent, Porcupine Vipond Mine, Schumacher, Ontario.

John William Stoner, B. S. Assistant City Engineer, Lead, S. D.

Joseph H. Saville, B. S., E. M. Foreman, Anaconda Copper Co., Anaconda, Mont.

Harry Ellis Wheelock, B. S. Mine Superintendent, Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Eleven

William L. Anderson, B. S., M. E., Mining Engineer, Rochester, Nevada.
Floyd Brooks, B. S. Mining Engineer, Sudbury District, Worthington, Ontario.
Chester G. Ehle, B. S., Municipal Engineering Dept., Portland, Oregon.
Fred J. Muhmel, B. S., Scotland, S. D.
Elwin H. Quinney, B. S., M. E. Assistant State Engineer, Pierre, S. D.
Frank H. Winsor, B. S. Graduate student, Columbia University, New York City.
Clarence G. Willard, B. S., M. E. Mill Superintendent, Golden Reward Mining Co., Deadwood, S. D.

Nineteen Hundred Twelve

Samuel C. Dickey, B. S. Millman, Lead, S. D.
Frank A. Fahrenwald, B. S., E. M., South Dakota School of Mines, M. S. Pennsylvania State College. Metallurgist for American Dental Association, University of Michigan, Ann Arbor, Mich.
Peter Mosier, B. S. Assayer for Mary Murphy Mining Co., Romley, Colorado.

Nineteen Hundred Thirteen

Alfred Alder, Jr., B. S. With Socorro Mining Co., Mogollou, New Mexico.
Amil A. Anderson, B. S. Assistant Metallurgist, Homestake Mine, Lead, S. D.
J. M. Hartegering, B. S. With Municipal Engineering Dept., Detroit, Mich.
Hugh M. Henton, B. S. Assayer for Ruby Mining Co., Zortman, Mont.

Nineteen Hundred Fourteen

W. C. Bochert, B. S. With Trojan Mine, Trojan, South Dakota.
Robert B. Eldredge, B. S. With Portland Mining Co., Colorado Springs, Colorado.

Arthur W. Fahrenwald, B. S., Graduate student, S. D. School of Mines, Rapid City S. D.
Lloyd L. Farnham, B. S. Superintendent Home Lode Mine, Silver City, S. D.
Leo Fleischman, B. S. Mine Superintendent, Rowena, Colorado.
Robert S. Hill, B. S. With Socorro Mining Co., Mogollon, New Mexico.
Willard J. McCauley, B. S., Aberdeen, S. D.
R. O. Meents, B. S., Idaho Springs, Colorado.
W. Cristy Pryer, B. S., Aberdeen, S. D.
George E. Stowell, B. S. With Trojan Mine, Trojan, South Dakota.

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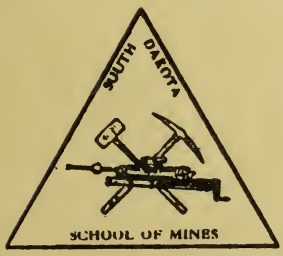

With Announcements
For 1916-1917

Rapid City, South Dakota

May, 1916

South Dakota State School of Mines

Annual Catalog 1915-1916

With Announcements
For 1916-1917

Rapid City, South Dakota
May, 1916

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JANUARY.

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SOUTH DAKOTA STATE SCHOOL OF MINES, RAPID CITY, S. D.

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College Calendar

1916

Registration Committee considers applications for advanced standing and credentials for admission ..... September 19
School Year begins ... Wednesday, September 20
Thanksgiving Recess ..... Nov. 23 to 25 inclusive
Christmas Vacation begins..... December 21

1917

Christmas Vacation ends ..... January 3
Short Course begins ..... January 8
Midyear Examinations.... Jan. 29 to Feb. 3 inc.
First Semester ends ..... February 3
Second Semester begins ..... February 5
Short Course ends ..... February 17
Washington's Birthday ..... February 22
Annual Field Trips ..... April 2 to April 9
Baccalaureate Sermon ..... May 27
Final Examinations ..... May 28 to June 2 inc.
Commencement and Conferring of Degrees.. ..... May 31

Regents of Education

Members of the Board

THEODORE W. DWIGHT, Sioux Falls,
Term expires January 1, 1921.
ALBERT M. ANDERSON, Sturgis,
Term expires January 1, 1917
AUGUST FRIEBERG, Beresford,
Term expires January 1, 1919
FRANK ANDERSON, Webster,
Term expires January 1, 1917
J. W. CAMPBELL, Huron,
Term expires January 1, 1921.

Officers of the Board.

THEODORE W. DWIGHT, President, Sioux Falls
IRWIN D. ALDRICH, Secretary, Big Stone City
A. W. EWERT, (State Treasurer), Treasurer Ex officio

Regents Committee in Charge of the School of Mines.

ALBERT M. ANDERSON FRANK ANDERSON

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology
A. B., Carthage College; Ph. D., Johns Hopkins University.

HOWARD LINCOLN McLAURY
Professor of Mathematics
A. B., Oberlin College; A. M., Harvard University

CLAUDE CORNELIUS VAN NUYS
Professor of Physics
A. B., Yankton College; B. S., E. M., South Dakota State School of Mines; A. M., Columbia University

JOSEPH HERBERT STEELE
Professor of Engineering
B. S., C. E., Michigan Agricultural College

JOHN McLEARIE
Professor of English
A. B., Macalester College; A. M., University of Chicago

CLARENCE LESLIE LEWIS
Lecturer on Mining Law
University of Michigan

WELTON JOSEPH CROOK
Professor of Metallurgy
Melbourne School of Mines; A. B., Leland Stanford University

JOSEPH JAMES RUNNER
Professor of Mineralogy and Petrography
A. B., University of Nebraska

*THEODORE SAUNDERS DUNN
Professor of Mining
B. S., M. S., Missouri School of Mines

MINER LOUIS HARTMANN
Professor of Chemistry
B. S., University of Arizona; Ph. D., Harvard University

*Resigned January 29, 1916.

WILLIAM C. BOCHERT
Associate Professor of Mining
B. S., South Dakota State School of Mines

HUGH W. TALBOT
Instructor in Preparatory Science and Mathematics
B. S., Colgate University

CORNELIA HERMANN
Instructor in Modern Languages and History
Ph. B., Iowa State University

WILLIAM A. COURSEN
Superintendent of Buildings and Grounds and Instructor in Machine Shop

DELLA MAY HAFT
Librarian
Ph. B., University of Chicago

BERTHA MORRIS
Registrar and Secretary to the President

Other Employees

ELWYN SMITH, Student Assistant in Chemistry.
RODNEY CRAGIN, Student Assistant in Metallurgy.
VIRGIL T. PRICE, Student Assistant in Chemistry.
HAROLD H. RUGG, Student Assistant in Physics.
J. HARLAN JOHNSON, Student Assistant in Geology.
MRS. A. O. ANDERSON, Janitor
FRANK BOYD, Fireman

Standing Committees of the Faculty

COMMITTEE ON ADMISSION AND REGISTRATION:
Professor Steele, Chairman,
Professor Runner,
Professor Van Nuys.

COMMITTEE ON EMERGENCIES:
Professor Van Nuys, Chairman,
Professor Hartmann,
Professor McLearie,
Professor McLaury,
Professor Runner.

COMMITTEE ON STUDENT WELFARE:
Professor McLaury, Chairman,
Miss Hermann,
Professor McLearie,
Mr. Talbot,
Professor Van Nuys.

COMMITTEE ON THESES AND DEGREES:
Professor Crook, Chairman,
Professor Hartmann,
Professor Runner,
Professor Bochert.

COMMITTEE ON ATHLETICS:
Professor Runner, Chairman,
Professor Bochert,
Professor McLaury.
Professor McLearie.

COMMITTEE ON SCHOOL MAGAZINE:
Professor McLearie, Chairman,
Professor Crook,
Professor Hartmann,
Professor Steele,
Professor Bochert.

COMMITTEE ON CATALOG:
Professor Steele, Chairman,
Miss Hermann.

COMMITTEE ON LIBRARY:
Mr. Talbot, Chairman,
Professor Crook,
Miss Haft,
Professor Steele.

BOARD OF CONTROL OF THE ATHLETIC ASSOCIATION:
Professor McLearie, Chairman,
Mr. Rodney Cragin, Secretary,
President O'Harra,
Professor Runner,
Mr. Harry Deutsch,
Mr. Frank Newbowers,
Dr. Charles McDowell.

PROFESSOR McLAURY, Secretary of the Faculty.

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 P. M.

RAPID CITY, LOOKING NORTHWEST

THE
JOHN CRERAR
LIBRARY

General Statement

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part by the state as state institutions.

The following is an extract from the act of the legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is pos-

sible, the school also aids the development of the mineral resources of the state by the investigation of mining and metallurgical problems which arise. At the present time, many graduates of the School are employed in responsible positions in the Black Hills and throughout the West generally, and are doing much toward the development of the state's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting and to cyanidation.

Recent demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this school, together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. These may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratory, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that pur-

pose. In 1903 $18,000 was appropriated by the legislature for a rear addition and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the Preparatory Building, $2,500 for replacements in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment, at the present time, is such as to give good facilities for thorough instruction in mining and metallurgy, and allied subjects.

Location

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of an equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit with

its particular and sometimes striking color yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills with its bold pinnacles and shoulders of coarse, bare granite rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately somber forms of porphyry buttes, there is presented a view well worth many hardships to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock-raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The total mineral production since the first mining in 1875 is approximately $190,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 4,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid creek 3200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminat-

ing gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but, to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses

The School of Mines has from the early days of its organization maintained classes in various branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in

proportion to the needs of the institution and now serves to give extended courses in these subjects. The Regents of Education have authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In conformity with this authorization a four years course in Electrical Engineering and a four years course in Civil Engineering have been outlined and these courses are now offered. In the purchase of apparatus for teaching these engineering courses efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In civil engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In electrical engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Four hydro electric plants on as many different mountain streams of the Black Hills and costing approximately two million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the

west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which students found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Engineering. The chemical laboratories comprize the general, qualitative, and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The Department of Civil Engineering consists of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop. The machine shop enables the School to make a very appreciable amount

RELIEF MAP OF THE BLACK HILLS

THE
JOHN CREAR
LIBRARY

of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories high, built of red brick covered with stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horsepower of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

Equipment

In general, the school is well equipped to carry on its work. It has the essential of modern sci-

entific technical instruction, ample laboratory facilities in all required branches.

Library

The library and reading room occupies a large, well lighted and well equipped room on the first floor of the Main building. Here are found the standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Economics, and many works of a general nature.

Authoritative scientific journals published in the United States, Canada, Mexico, England and Germany are found on the reading tables and are bound when volumes are completed—putting in substantial form the latest research in the sciences taught in this school.

The learned societies of the United States and England are represented by the publications of the Royal Society of London, of the Institution of Mining and Metallurgy, of the Institution of Mining Engineers, of the Iron and Steel Institute and of the American Institute of Mining Engineers, of the American Chemical Society, of the Society of Chemical Industries and of the American Institute of Electrical Engineers.

The library is the repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

The Dewey system of classification is used and a card index gives author, title and subject.

The privileges of the Library are extended to those not attending the college who may find use for its books of reference.

Drawing Rooms

In the Department of Engineering are two

large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photochemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The laboratories have been overhauled this year and the woodwork and desks refinished. The hoods have also been rearranged in order to get

better ventilation and new ones have been installed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, calorimeters for fuel analysis, spectroscopes for qualitative experiments, and electroscopes for determination of radium and uranium in waters, gases, and minerals.

Biological Laboratory

The equipment in this laboratory is modern and suitable for bacteriological, zoological and botanical purposes. A large Alberene stone aquarium containing aquatic plants and animals is maintained to show their interrelations and habits of growth and reproduction. We have excellent charts and slides which greatly aid in the study of living material. Compound and dissection microscopes are used throughout the work. Our large herbarium and a collection of representative animal forms are used to great advantage in obtaining interest and proficiency.

Physical Laboratory

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, reciprocating and mercury air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for com-

plete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for calorimetric determinations of specific heat by the method of mixtures, Waterman's method, Bunsen's method, or the cooling method, Mahler-bomb calorimeter for heat of combustion, latent heat of vaporization, etc., Dalton's apparatus, complete apparatus for the determination of the mechanical equivalent of heat, Regnault's apparatus; seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltameters, fluxmeters, permeameters, Woulff precision resistances; also completely equipped switch-boards for both high and low voltage distribution of direct or one, two or three phase alternating current, made by Max Kohl of Germany, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-Ray apparatus, spark and arc spectrum apparatus; a variety of dynamos, motors, motor-generator set, induction machines, gasoline engines, and models of steam and gas engines.

The School also possesses a completely equipped wireless telegraph station consisting of a send-

ing set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two, or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound rotor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the School heating and lighting plant and the equipment of the Department of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes. The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, two Gurley transits, one with solar attachment, one Keuffel and Esser transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, levelling rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of

the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fire-proof. There is a melting furnace using coke, and gasoline furnaces made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattee, flue dust, fume, and umpire sample for close checking work.

Mining and Metallurgical Laboratories

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 11 and 13, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance, pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, cop-

per and lead, and is best adapted to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3 1-2 ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3 1-2 ft. solution storage tanks; two 4x3 1-2 ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2 1-2 ft. Pachuca tank is used, while for slime thickening and filteration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1 1-2 in. centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed

that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with six metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus, of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat experiments and for metallography.

Mineralogical Laboratory

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department upon the payment of a small fee. Each student has his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed

tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large speciments of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique rock section of the Homestake mine, donated by the Homestake Mining Company of Lead, South Dakota. Many framed maps of mines and important

geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The school is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops

In the basement of the Main Building a small machine shop is provided, containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for the design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the upper classes are granted permission to use the facilities afforded by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department, a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Ten have been published. They are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. (*Out of Print.*)

By F. R. Carpenter and H. O. Hofman.

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Silicious Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. (*Out of Print.*) By C. C. O'Harra.

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. (*Out of Print.*)

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. (*Out of Print.*) By C. C. O'Harra.

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr. and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. (*Out of Print.*)

Bulletin No. 10—The Minerals of the Black Hills, 200 pages. 1914. By Victor Zeigler.

The Pahasapa Quarterly. This is a magazine published by the students with the assistance and general supervision of the faculty. As its name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

STUDENTS' EXPENSES

Tuition

The tuition and incidental fee is $6 per semester, or $12 per year, *payable in advance on registration.* This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees and Deposits

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 6-7, Qualitative Analysis, per semester ..... $ 5.00
Chemistry 8, Quantitative Analysis, per semester 6.00
Chemistry 9, Metallurgical Analysis, per semester 6.00
Metallurgy 11-13, Metallurgical Laboratory,

per semester 5.00
Metallurgy 15, Cyanide Testing, per semester 5.00
Metallurgy 2, Assaying, per semester 5.00
Students' Activities Fee, required of all regularly enrolled students, per semester.. 3.00
Fee for bachelor's degree 5.00
Fee for advanced degree 10.00
Fee for permit for "conditioned" examination 2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named . The unused portion of each deposit will be returned to the student at the end of each semester.

Metallurgy 15, Cyanide Testing, deposit ..$20.00
Metallurgy 2, Assaying, deposit 20.00
General breakage deposit for engineering students taking laboratory courses in Chemistry or Metallurgy 5.00

No platinum is furnished by the Department of Chemistry.

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses

Board and room may be obtained in town with private families or in boarding houses or hotels,

at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $4.50 upwards per week. This makes the expense for board and room for the school year of 35 weeks range from $160 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books

Freshman year	$13.00
Sophomore year	17.00
Junior year	20.00
Senior year	19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshman year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added according to individual taste.

Incidental Expenses

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshman year usually costs the student about $10. The surveying trip in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from

$30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

Athletic Association

The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basketball teams, and track athletics. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits. The Students' Activities Fee gives access to athletic

grounds and pays for admission to games and for subscription to the Pahasapa Quarterly.

Conduct

The school has no codified rules of conduct. Students are held to a strict account of their work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

ASSAYING, CHEMICAL ANALYSES AND DETERMINATIONS OF MINERALS AND ROCKS

The school aims to assist the prospector and mining man in every reasonable way in determining the value of such minerals and ores as he may have. For residents of South Dakota minerals and rocks not requiring careful analysis are determined free of charge. Assays for gold and silver are made for 25 cents per sample. Many qualitative chemical analyses are made free and quantitative analyses are made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same should be addressed to the President of the School of Mines.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fifteen units are necessary for entrance.

Required Units

Algebra .....1.5 units
Plane Geometry .....1 unit

Solid Geometry	0.5 unit
English	3 units
History	1 unit
Physics or Chemistry	1 unit
Total required units	8 units

Elective Units

German	1, 2 or 3 units
French	1, 2 or 3 units
Latin	2, 3 or 4 units
Greek	1 unit
Spanish	1 or 2 units
English	1 or 2 units
History	1 or 2 units
Mathematics	0.5 unit
Science	1 or 2 units
Drawing	1 unit
Shop Work	1 unit
Civil Government	0.5 unit
Bookkeeping	1 unit
Elective units required for entrance	7 units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School

Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Other candidates for admission will be given credit for so many of the fifteen required units as they may bring credits for, and will be permitted to make up the remainder in the Preparatory Department of the School of Mines, which is maintained for the special purpose of preparing students found deficient in entrance requirements.

Credentials for entrance should be in the hands of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units

Mathematics: The three units which may be offered in mathematics are as follows:

Algebra—One and one-half units. The equivalent of A, B and C Algebra described under Preparatory Mathematics in the Preparatory Catalog.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Three units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Catalog.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Catalog.

History—One unit. The History of the United States, English, Ancient or Modern History as described under History in the Preparatory Catalog.

Elective Units

The equivalent of courses, not mentioned

above, described under Mathematics, (Trigonometry only), Languages, History, English and Preparatory Science, in the Preparatory Catalog.

Special Students

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

GENERAL STUDIES

The South Dakota School of Mines is frequently approached by students, both men and women, who have no ambition to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more general interest offered in the engineering and preparatory courses. To all such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their cultural benefit. The attention of persons so minded is called to the following list of subjects, all taken from the regular courses, which have a general educational value: English literature, foreign languages—including French, German and Spanish,—history, sociology, economics, mathematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing. From

these subjects a course may easily be selected corresponding to the first two years of a general college curiculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Short Course

A Short Course, of six weeks duration, is offered each year, begininng with the assembling of school after the Christmas vacation. This course is designed for prospectors and miners and other men of maturity who have had practical experience but who have had no opportunity to acquire a technical education. For such men the school offers, during the midwinter weeks, an opportunity to gain some insight into those principles of their work which practice alone will not provide. Instruction is given in the following subjects: Assaying, Cyaniding, Chemistry, Mineralogy, Geology, Ore Dressing and Mining Law. The tuition fee, payable at time of registration, will be six dollars plus the cost of such materials as may be used up in the laboratories.

A feature of interest is that men having ores or minerals of their own will be given opportunity to make tests upon them in so far as such can be done without interfering with the other work of the institution. Every effort will be put forth to make this work both practical and helpful. No credit toward a degree will be given for work pursued in this course.

Summer School

The summer school in surveying begins immediately after commencement and occurs be-

tween the sophomore and junior years. The electrical engineers spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mining surveying, and the students in civil engineering spend six weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mining surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Preparatory Department

The School of Mines finds it necessary to maintain a Preparatory Science Course on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part

of the curriculum of the School of Mines. The faculty decide these cases upon the basis of individual merit.

Degrees

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineer's degree should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and

approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Preparatory department will receive a certificate to that effect.

Thesis

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree.

At the beginning of the school year the individual members of the senior class are expected to consult with the thesis committee of the faculty regarding the subjects for their thesis. Preference will be given to subjects selected by the student, provided they meet the approval of the committee. Students unable to select subjects for themselves will be assigned subjects by the committee.

Report of progress in thesis work must be made at stated intervals to the thesis committee. Theses must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8 1-2x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning theses are fully satisfied.

The following is a list of the theses submitted since 1903:

1904. Arentz, S. S. Some Experiments on Bromo-Cyanogen.
Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.
West, Elmer W. Notes on Assay Slags.

1905. Anderson, O. A. The Grand View Mining

Property with Plan and Estimated Cost of Development Work and Reduction Plant.

1906. Coolidge, E. B., and Gains, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whylock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

1907. Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines Including Metallurgical Treatment.

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report

on the Coolgarde Group of Claims, Ida Gray Mining District.

1908. Coolidge, Cyril and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

1909. Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

1910. Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of its Ore.

Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

1911. Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

1913. Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

1914. Bochert, W. C. Metallurgical Treatment of A Typical Refractory Siliceous Ore.

Eldredge, Robert B. Experiments in Ore Flotation.

Fahrenwald, Arthur W. Report on the Metallurgical Investigation of A Blue Ore.

Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.

Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.

Hill, Robert S. Notes on Beryllium.

McCauley, Willard J. An Investigation of the Irrigation Possibilities of Little Elk Creek.

Meents, R. O. Leaching A Copper Ore.

Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.

Stowell, George E. The Geology of Silver City and Vicinity.

1915. Booth, L. E. and Thiel, Arthur. Electroly-

sis of Alkaline Solutions of Potassium Sulphocyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

COURSES AND DEPARTMENTS

The courses given by the School of Mines are:

Mining Engineering Course .....4 years
Metallurgical Engineering Course .....4 years
Civil Engineering Course .....4 years
Electrical Engineering Course .....4 years

SYNOPSIS OF COURSES

MINING ENGINEERING COURSE

First Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical Drawing ..		6
	17	15
Second Semester—	Lectures	Lab.
Mathematics 8—Analytic Geometry ..	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing ..		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5—Surveying	3	3
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year

First Semester—	Hours per week. Lectures	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Geology 3—Petrology	3	4½
Civil Engin. 7—Topographic drawing		1½
Civil Engin. 9—Machine design		6
Metallurgy 1—General	3	
Mining 3—Ore dressing	3	3
	16	18

Second Semester—	Lectures	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	

Geology 4—Physical geology	3	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
	16	18

Fourth Year

	Hours per week.	
First Semester—	Lectures	Lab.
Elec. Engin. 3—General	4	3
Geology 5—Economic	4	
Mining 5-7—Mine operation	5	
Mining 9—Mine design		6
Metallurgy 3—Gold and silver	3	
Metallurgy 5—Copper and lead	2	
Metallurgy 11—Laboratory		3
Thesis		3
	18	15
Second Semester—	Lectures	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Geology 6—Economic	4	
Mining 6-8—Mine operation	5	
Mining 10—Mine design		6
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Metallurgy 4—Iron and steel	2	
Thesis		6
Metallurgy 12—Mill run		week
	19	15

METALLURGICAL ENGINEERING COURSE

First Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5—Surveying	3	3
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3

Mining 2—Tunneling, shaft sinking ..	2	
	14	21

Summer Surveying three weeks.

Third Year

	Hours per week.	
First Semester—	Lectures	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Chemistry 9—Metallurgical	2	6
Civil Engin. 7—Topographic drawing .		1½
Civil Engin. 9—Machine design		6
Mining 3—Ore dressing	3	3
Metallurgy 2—General	3	
	15	19½
Second Semester—	Lectures	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Chemistry 10—Applied physical	2	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
	15	18

Fourth Year

	Hours per week.	
First Semester—	Lectures	Lab.
Elec. Engin. 3—General	4	3
Metallurgy 7—Gold and silver	4	
Metallurgy 9—Copper and lead	5	
Metallurgy 13—Laboratory		6
Metallurgy 15—Laboratory		9
Mining 5—Mine operation	2	
Thesis		3
	15	21

Second Semester—	Lectures	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermo dynamics	3	1½
Metallurgy 4—Iron and steel	2	
Metallurgy 6—Electrometallurgy	2	
Metallurgy 8—Calculations	2	
Metallurgy 10—Metallurgical design		6
Mining 6—Compressed air	2	
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Thesis		6
Metallurgy 12—Mill run		week
	16	15

CIVIL ENGINEERING COURSE

First Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Physics 3—General	3	3
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5A—Surveying	3	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Physics 4—General	4	6
Civil Engin. 8—Astronomy	2	
Civil Engin. 4A—Descriptive geometry		6
Civil Engin. 6A—Surveying	3	6
Mining 2—Tunneling, shaft sinking	2	
	16	18

Summer surveying six weeks.

Third Year

First Semester—	Hours per week. Lectures	Lab.
Physics 5—Analytic mechanics	4	
Civil Engin. 7A—Topographic drawing		3
Civil Engin. 11—Graphics		3
Civil Engin. 13—Railroad engineering.	4	3
Civil Engin. 9—Machine design		6
Civil Engin. 15—Cement and concrete.	2	
Metallurgy 1—General	3	
Sociology	3	
	16	15

Second Semester—	Lectures	Lab.
Civil Engin. 14A—Mechanics of materials	5	
Civil Engin. 16—Testing	2	6
Civil Engin. 12—Graphics		3
Civil Engin. 18—Stereotomy		3
Civil Engin. 26—Sewers	2	
Steam Engineering—Power plants and thermodynamics	3	1½
Metallurgy 4—Iron and steel	2	
Economics	3	
	17	13½

Fourth Year

	Hours per week.	
First Semester—	Lectures	Lab.
Elec. Engin. 3—General	4	3
Civil Engin. 23—Roofs and bridges	3	6
Civil Engin. 25—Dams and retaining walls	3	
Civil Engin. 27—Arches and foundations	2	
Civil Engin. 29—Roads and pavements	3	
Civil Engin 31—Contracts and specifications	1	
Thesis		6
	16	15

Second Semester—	Lectures	Lab.
Physics 6A—Hydraulics	4	3
Civil Engin. 24—Roofs and bridges	3	6
Civil Engin. 30.—Irrigation, water power and supply	5	
Civil Engin. 32—Framed structures	3	3
Thesis		6
	15	18

ELECTRICAL ENGINEERING COURSE

First Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Elec. Engin. 1—Elementary	2	3
Civil Engin. 3—Descriptive geometry.		6
Civil Engin. 5—Surveying	3	3
Civil Engin. 9—Machine design		6
Physics 3—General	3	3
	13	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Elec. Engin. 2—Elementary	2	3
Civil Engin. 4—Descriptive geometry		3
Civil Engineering 6E—Surveying	1½	3

Civil Engin. 10—Graphics		3
Physics 4—General	4	6
	12½	18

Summer surveying two weeks.

Third Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 13—Differential equations	3	
Physics 5—Analytic mechanics	4	
Elec. Engin. 3—General	4	3
Elec. Engin. 5—Measurements		6
Elec. Engin. 7—Electrical design		6
Sociology	3	
Metallurgy 1—General	3	
	17	15

Second Semester—	Lectures	Lab.
Physics 8—Light and electrons	2	3
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Civil Engin. 16E—Testing laboratory	2	3
Civil Engin. 14—Mechanics of materials	4	
Economics	3	
Elec. Engin. 6—Measurements		3
Elec. Engin. 8—A. C. Laboratory		3
Shop Work 8—Winding laboratory		3
	16	18

Fourth Year

	Hours per week.	
First Semester—	Lectures	Lab.
Electro-metallurgy	2	
Electro-chemistry	3	
Elec. Engin. 9—Distribution and control	3	
Elec. Engin. 11—A. C. machinery	4	

Elec. Engin. 13—Laboratory		6
Elec. Engin. 15—A. C. theory	3	
Electrical Design		6
Thesis		6
	15	18

Second Semester—	Lectures	Lab.
Elec. Engin. 12—Hydro-electric plants	3	
Elec. Engin. 14—Laboratory		6
Elec. Engin. 16—Telegraphy and telephony	2	
Elec. Engin. 18—Elec. railways	3	
Elec. Engin. 20—Steam-electric plants	2	
Elec. Engin. 22—Illumination	2	
Elec. Engin. 24.—Management	3	
Electrical Design		6
Thesis		6
	15	18

Engineering students wishing to study Spanish, French or German, have the privilege of taking a five hour course in these subjects by making proper arrangements therefor, providing the total number of lecture hours carried does not exceed eighteen per week.

PREPARATORY SCIENCE COURSE

First Year

First Semester—	Lectures	Lab.
Mathematics 1—Algebra	5	
English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient history	5	
Shop Work 1—Wood shop		6
	18	9

Second Semester—	Lectures	Lab.
Mathematics 2—Algebra	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediaeval history	5	
Shop Work 2—Wood shop		6
	18	9

Second Year

First Semester—	Lectures	Lab.
Mathematics 3—Geometry	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Shop Work 3—Forging		3
	18	6

Second Semester—	Lectures	Lab.
Mathematics 4—Geometry	5	
English 4—Rhetoric	5	
History 4—U. S. history	5	
Biology 4—Botany	3	3
Shop Work 4—Molding and casting		3
	18	6

Third Year

First Semester—	Lectures	Lab.
French 1 or Spanish 1	5	
German 1	5	
Biology 5—Zoology	3	6
English 5 or 7—English or American Literature	5	
Freehand drawing		3
	18	9

Second Semester—	Lectures	Lab.
French 2 or Spanish 2	5	
German 2	5	
Astronomy	3	3
English 6 or 8—English or American Literature	5	
Physical Geography	3	3
Freehand Drawing		3
	21	9

Fourth Year

First Semester—	Lectures	Lab.
Chemistry 1	3	6
German 3 or French 3 or Spanish 3	5	
Physics 1	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures	Lab.
Chemistry 2	3	6
German 4 or 6 or French 4 or Spanish 4	5	
Physics 2	4	6
Mathematics 6—Algebra	5	
	17	12

Department of Geology and Mineralogy

Professor O'Harra Professor Runner

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, endesite, dacite, etc., occur in

the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena,

such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year: Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Chamberlain and Salisbury's College Geology.

Mineralogy 1

Crystallography: Eight weeks are given to the study of symmetry, forms and classification of crystals. In the laboratory the student becomes familiar with the various types of crystals through the study of models and later is required to identify the forms of one hundred mineral crystals.

Physical Mineralogy: The remainder of the semester is devoted to the physical properties of minerals in general and the composition, forms, properties, occurrence, association, origin and uses of one hundred of the more common minerals are studied in detail. In the laboratory seven hundred unlabeled specimens of the minerals discussed in the class room are determined from their physical properties alone. The course is planned to develop such information as may be needed for the quick and accurate determination of minerals in the field.

Sophomore Year, First Semester. Two lec-

ture periods and three laboratory hours per week. Text: Rogers' Study of Minerals.

Mineralogy 2

General Mineralogy and Blow Pipe Analysis: The chemical properties and relations of minerals and the methods of blow pipe and other chemical analyses for their determination are first studied, after which the chemical and physical properties, origin, associations and uses of about one hundred mineral species are taken up, special emphasis being paid to ore and common rock forming minerals. The laboratory work consists of the determination of approximately one thousand four hundred unlabelled specimens of minerals by means of chemical tests and physical properties. A detailed report of all results obtained is made out and kept for reference. It is expected that upon completion of this and the preceding course the student will have gained a good working knowledge of over two hundred of the common minerals including the chief factors of their distribution, uses, value and output.

Sophomore Year, Second Semester. Two lecture periods and six laboratory hours per week.

Texts: Rogers' Study of Minerals. Lewis' Determinative Minerals.

Geology 3

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs and indicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and

the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rock, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Zirkel and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence, and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, First Semester, Mining Engineering option: Three lecture periods and four and one-half laboratory hours per week.

Reference books: Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and their Origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 4

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations is next taken up followed by a brief summary of the modern ideas on diastrophism and isostacy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Junior Year, Second Semester, Mining Engineering option. Three lecture periods per week.

Text: Leith's Structural Geology. Lecture notes.

Geology 5-6

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mer-

cury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology of the United States; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits.

Civil Engineering

PROFESSOR STEELE

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position, and to teach him so much of the underlying theory and principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture rooms and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Civil Engineering 1-2

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, machine details, and both free hand and mechanical lettering of

titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6-in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers,
One 5½ in. ruling pen,
One 3½ in. steel spring bow divider,
One 3½ in. steel spring bow pencil,
One 3½ in. steel spring bow pen,
One T square with 30 in. blade,
One 4½ in. protractor,
One irregular curve,
One 7 in. 30° by 60° triangle,
One 8 in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Civil Engineering 3-4

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six lab-

oratory hours per week; second semester, three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Civil Engineering 4A

Descriptive Geometry: Similar to Civil Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six laboratory hours per week.

Civil Engineering 5-6

Surveying. Plane Surveying. It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each party to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city

surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year: Three lecture periods and three hours field work per week during the year.

A three week's summer school for practical work immediately follows the close of school in June. This includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Johnson's Theory and Practice of Surveying.

Civil Engineering 5A-6A

Surveying: Course similar to Civil Engineering 5-6, but amplified for Civil Engineering students. In addition to the subjects mentioned under the preceeding course, this course treats of geodetic surveying including base line measurement, triangulation and measurement of angles, trigonometric and precise levelling and map projection.

Three hours lectures and six hours field work per week during the Sophmore year, followed by six weeks summer field work.

Civil Engineering 6E

Plane Surveying: Same as Plane Surveying under Course 6, but does not include Mine Surveying. Sophomore Year, Electrical Engineering Course, Second Semester. Three hours lectures per week for one half semester; three hours field work per week for one semester, followed by two weeks summer field work.

Civil Engineering 7

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week for eight weeks.

Civil Engineering 7A

Topographic Drawing: This course includes the same subjects as Course 7, but the work is amplified for Civil Engineering students. Prerequisite Civil Engineering 5A-6A.

Junior Year, First Semester: Three laboratory hours per week.

Civil Engineering 8

Astronomy: A short course in Field Astronomy for Civil Engineering students, special attention being given to the observations for azimuth, latitude, longitude and time. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second Semester: Two lecture periods per week.

Civil Engineering 9

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. Draft

ing room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week.

Civil Engineering 10-11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amounts of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: Three laboratory hours per week. Course 11-12 is for Civil Engineering students and extends throughout the year. Course 10 is for all other students and is given during the second semester.

Text book: Hoskins, Elements of Graphic Statics.

Civil Engineering 13

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, road-bed, ballast, bridges, culverts, yards, elevation of outer rail, signals, locomotives, curve and grade problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course. Four lecture hours and three laboratory hours per week.

Civil Engineering 14

Mechanics of Materials: The resistance and

elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Civil Engineering 14A

Mechanics of Materials: This is a somewhat more extended course than the preceding, and is given five lecture hours per week. It includes all the work given in the text book above mentioned.

Junior Year, Second Semester, Civil Engineering Course.

Civil Engineering 15

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete.

Junior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 16

Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14 or 14A.

Junior Year, Second Semester, Civil Engineering Course. Two hours lectures and six hours laboratory work per week.

Civil Engineering 16E

Testing Materials: A course for Electrical Engineering students, similar to Civil Engineering 16, but with the laboratory work abridged to three hours per week.

Civil Engineering 18

Stereotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Three laboratory hours per week.

Civil Engineering 23-24

Roofs and Bridges: A study of the usual designs of roof and bridge trusses, with calculations of stresses and drawing room work in design. Must be preceded by Civil Engineering 11-12.

Senior Year, Civil Engineering Course. Three lecture periods and six laboratory hours per week during the year.

Civil Engineering 25

Dams and Retaining Walls: A study of various types of dams and weirs, including timber, earth, masonry and rock fill dams, and of retaining walls.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 26

Sewers: The various ways of disposal of sewage, sewer design and construction.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 27

Arches, Masonry and Foundations: The theory and design of arches, the methods and materials of construction of foundations and masonry structures.

Senior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 29

Roads and Pavements: The modern construction of earth roads, country highways, city streets and pavements, materials, methods, economics and costs.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 30

Irrigation, Water Power and Supply: The storage and distribution of water for irrigation and power. Water works for small cities.

Senior Year, Second Semester, Civil Engineering Course. Five lecture periods per week.

Civil Engineering 31

Contracts and Specifications. A course of one hour per week of reading and recitations.

Senior Year, First Semester, Civil Engineering Course.

Civil Engineering 32

Framed Structures: Structural details, the principles of detail design of members and joints in timber and steel construction.

Senior Year, Second Semester, Civil Engineering Course. Three lecture periods and three laboratory hours per week.

Department of Physics and Electrical Engineering

PROFESSOR VAN NUYS

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

Especial attention is given to the general laws underlying the science, and the history of the discovery and development of the important results is considered carefully. In the laboratory courses, the purpose is to excite in the student an interest in experimentation and to develop the ability for careful observation and the testing and sifting of results.

The courses offered by the department are as follows:

Physics 3

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 5. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics.

The aim of the laboratory work in this and the

following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of calorific power of fuels, specific and latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves.

First Semester: Sophomore Year for Civil and Electrical Engineers, Junior Year for Mining and Metallurgical Engineers. Three lecture periods and three laboratory hours per week.

Text Book: Duff's Text Book of Physics.

Physics 4

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, electromagnetism and electromagnetic induction are considered in detail, and a careful study of the theory of electrical measurements is made.

The subject of light is considered from the standpoint of the electro-magnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

The equipment for optics and electrical measurements in the accompanying laboratory work is described on page 20 and is ample for effective work along these lines.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Second Semester, as above. Four lecture periods and six laboratory hours per week.

Physics 5

Analytic Mechanics: The theory is developed by lectures. Many problems will be solved to enforce the principles and to develop ability in the student to apply what he has learned to practical problems. Particular effort is made to cultivate the power of the student to use calculus methods when needed. The course includes the following subjects:

Statics: First principles; units, composition and resolution of concurring forces; composition and resolution of forces acting on a rigid body; conditions of equilibrium center of gravity; friction, virtual velocities; machines; the funicular polygon and the catenary.

Kinematics: Rectilinear and curvilinear motion; composition and resolution of acceleration; angular velocity and angular acceleration; projectiles, etc.

Kinetics: Laws of motion; motion under the action of a variable force; motion in a resisting medium; constrained motion; the simple pendulum; centripetal and centrifugal forces. Impact; work and energy; moment of inertia.

Junior Year, First Semester: Four lecture periods per week.

Physics 6

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 3, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for weir and velocity measurements; two large irrigation ditches are adjacent to the

school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Two lecture periods and three laboratory hours per week for eight weeks. Junior Year for Electrical Engineering students.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Physics 6A

Hydraulics: A more extended course than Physics 6, for Civil Engineering students.

Senior Year, Second Semester. Four lecture periods and three laboratory hours per week.

Physics 8

Electromagnetic theory of light and theory of electrons. Junior Year, First Semester, Electrical Engineering Course. Two lecture periods and three laboratory hours per week.

Electrical Engineering 1-2

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Sophomore Year, Electrical Engineering Course. Two hours lectures and three hours laboratory per week.

Electrical Engineering 3

This course deals with the principles and general construction of dynamo-electric machinery; systems of direct current distribution; direct current motors, their action, control and application; the principles and general construction of alternating and polyphase dynamo electric machinery;

systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments in the operation and testing of direct and alternating current generators, motors and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of all other courses: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Franklin & Esty, Elements of Electrical Engineering, 2 Vols.

Electrical Engineering 5-6

Electrical Measurements: Junior Year Electrical Engineering Course. Six laboratory hours per week during the first semester and three laboratory hours per week during the second semester.

Electrical Engineering 7

Electrical Design: Drafting room work. The mechanical design of direct current generators and motors, alternating current generators and synchronous and induction motors.

Junior Year, Electrical Engineering Course, First Semester: Six laboratory hours per week.

Electrical Engineering 8

Alternating Current Laboratory, Junior Year, Second Semester, Electrical Engineering Course: Three laboratory hours per week.

STEAM ENGINEERING

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engines,

air compressors and refrigerating machines are fully discussed.

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and kerosene engine. This apparatus is also available for laboratory work in this course.

Second Semester. Junior Year for Civil and Electrical Engineering Courses, Senior Year for Mining and Metallurgical Engineering Courses. Three lecture periods per week for the semester and three laboratory hours per week for half a semester.

Department of Chemistry

PROFESSOR HARTMANN

The courses in Chemistry are designed to give to engineering students the knowledge of chemistry most essential to their work. The subject is given in all courses according to the modern electrolytic dissociation theories. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation and to teach the proper correlation of the results of experiments.

Chemistry 3-4

General and Elementary Physical Chemistry. This course is designed to give to the student a knowledge of the theories and laws of the science as well as to increase his knowledge of general chemistry facts. Before entering this class the student must have had either Chemistry 1 and 2 (see Preparatory Catalog) or a good high school course in Chemistry. The following subjects are discussed: atoms and molecules, gases, liquids and solids, solutions, thermo- and electro-chemistry. Special attention is given to the theories of electrolytic dissociation and the law of mass action. The laboratory work in the first semester is designed to show the application of some of the principal generalizations.

Freshman Year. First Semester: Four lecture periods and six laboratory hours per week. Second Semester: Two lecture periods per week.

Chemistry 6

Qualitative Analysis: The work in qualitative analysis begins with an outline of the general scheme of analysis. A minute study of the separation and detection of the common acids and bases follows. Emphasis is placed upon the general principles of chemistry involved, especially the electrolytic dissociation theory and the mass action law. The aim of this course is to teach the student the reasons for every step in the separation and identification of the elements and to develop the idea of quantity as well as quality.

Freshman Year, Second Semester. Two lectures and six laboratory hours per week.

Chemistry 7

Advanced Qualitative Analysis. An advanced course to follow Chemistry 6. The methods of analysis of commercial products and minerals are discussed fully. The detection of a number of the rarer elements is also a part of this course. The quantitative idea is emphasized.

Sophmore Year, First Semester. Three lectures and six laboratory hours per week.

Chemistry 8

Quantitative Analysis. This course covers the general principles of quantitative analysis and includes the analysis of simple substances by both gravimetric and volumetric methods. The subject of chemical calculations is discussed and problems are solved.

Sophomore Year, Second Semester. Two lecture periods and twelve laboratory hours per week.

Chemistry 9

Metallurgical Chemistry: This course is to familiarize the student with the analytical meth-

ods used in conjunction with metallurgical processes. Especial reference is made to the analysis for the rare elements found in the Black Hills region, and to the technical methods connected with the metallurgy of iron, steel, zinc, lead and copper.

Junior Year, First Semester, Metallurgical Engineering Course. Two lectures and six laboratory hours per week.

Chemistry 10

Applied Physical Chemistry. This is a brief course to study some of the physico-chemical problems connected with the metallurgical industries.

Junior Year, Second Semester, Metallurgical Engineering Course. Two lectures per week.

Chemical Research

Opportunity will be given for original research work along chemical lines to students qualified to undertake such work.

Department of Metallurgy

PROFESSOR CROOK.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a fur-

nace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 1

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blast; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room and hand in for examination papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 11,

Junior Year, First Semester: Three lecture hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 2

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reac-

tions occuring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and the excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloy for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Fulton, Manual of Fire Assaying.

Metallurgy 3

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is taken up in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is taken up. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by per-

colation; the treatment of slimes by decantation, filter pressing and vacuum filteration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior Year, Mining Engineering Course, First Semester. Three hours per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook.

Metallurgy 4

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, Second Semester: Two hours per week. Lecture notes.

Metallurgy 5

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable

for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up, also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining Option, First Semester: Two hours per week.

Reference Works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting; Iles, Lead Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 6

Electro-Metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, silver, lead, nickel and tin.

Electrothermic processes. Theory. The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc, and for miscellaneous purposes.

Senior Year. Metallurgical Option, Second Semester: Two hours per week.

No text book required. Reference works: Stansfield, The Electric Furnace; Borches, Electric Smelting and Refining.

Metallurgy 7

Gold and Silver: This course is similar to Metallurgy 3 but is given for four lecture periods per week to students taking the Metallurgical Engineering Course.

Senior Year, First Semester.

Metallurgy 8

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important calculations in connection with the practice of thermo-chemistry, copper smelting, lead smelting and electro-metallurgy.

Metallurgical Option, Senior Year, Second Semester. Two hours per week.

Metallurgy 9

The Metallurgy of Copper and Lead: The same as Metallurgy 5, except that it is amplified by detail.

Senior Year, Metallurgical Otpion, First Semester: Five hours per week.

Text Books: Peters' Practice of Copper Smelting; Hofman's Metallurgy of Lead.

Metallurgy 10

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5-stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Six laboratory hours per week for the second semester.

Metallurgy 11

Metallurgical Laboratory: Laboratory practice in pyrometry; calibration of the thermo-couple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 12

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 13

Metallurgical Laboratory: Course similar to Metallurgy 11, but amplified.

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 15

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester; Nine hours per week.

Metallurgical Research

Research Work: Times and fees by arrangement.

Department of Mining

ASSOCIATE PROFESSOR BOCHERT

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal fea-

tures being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 1

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Sophmore Year, First Semester: Three lecture periods per week.

Mining 2

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Sophomore Year, Second Semester: Two lecture periods per week.

Mining 3

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Three lecture periods and three laboratory hours per week.

Mining 5

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tram ways and aerial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 6

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 7

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester. Three lecture periods per week. Mining Engineering Option.

Mining 8

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the elec-

tric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 9-10

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 12

Mine Examination: Sampling of ore bodies, estimation of "ore in sight" and valuation of mining properties; forms of report.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods

of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Senior Year, Second Semester: Two lecture periods per week.

Mining 14

MR. C. L. LEWIS

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate, the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, Second Semester: One lecture period per week for twelve weeks.

Department of Mathematics

PROFESSOR McLAURY

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before en-

tering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses.

Mathematics 7

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8

Analytic Geometry: This course includes the following subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry.

Mathematics 9

Differential Calculus: The text book work is supplemented by lectures. This course will include a short-course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10

Differential and Integral Calculus: This course is a continuation of the last course and will

include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11

Differential Equations, Junior Year. First Semester, Electrical Engineering Course: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

Department of English

PROFESSOR McLEARIE

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Steeves and Ristine's Representative Essays in Modern Thought.

English 10

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study

is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Sociology

This course is introductory in character. It consists of lectures and required readings on the content and methods of Sociology. The physical, biological and psychological aspects of social evolution will be discussed. As far as possible a number of modern social problems will be considered.

Junior Year, First Semester: Three lecture periods per week.

Economics

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

Spanish

To meet the needs of mining engineers and others who go to regions where that language is spoken, an option course in Spanish is offered. Courses in French and German are also given.

Five hours per week during the year.

SHOP WORK

MR. COURSEN.

Shop Work 8

Winding Laboratory: Junior Year, Electrical Engineering Course. Second Semester: one afternoon per week.

List of Students; 1915-1916

Senior Class

Cragin, Rodney .....Arpan, S. D.
Dennis, Paul .....Hot Springs, S. D.
Hill, Joseph H. .....Rapid City, S. D.
Smith, Elwyn ..... Colorado Springs, Col.

Junior Class

Cremer, Frank .....Parkston, S. D.
Deutsch, Harry .....Rapid City, S. D.
Johnson, J. Harlan .....Philadelphia, Pa.
Price, Virgil T. .....Rapid City, S. D.
Rugg, Harold H. .....Rapid City, S. D.
Snyder, William E. .....Onida, S. D.
Turner, Frank A. .....Faulkton, S. D.

Sophomore Class

Beutner, Adolph .....White Lake, S. D.
Clark, Edwin .....Rapid City, S. D.
Fredrichsen, Arne .....Nemo, S. D.
Newbowers, Frank .....Rapid City, S. D.
Norris, Paul .....Haydraw, S. D.
Tolton, Fay .....Fort Bennett, S. D.
White, Luther M. .....Dressor, Illinois

Freshman Class

Dier, John .....Rapid City, S. D.
Dutt, Earling .....Beulah, Wyoming
Hall, Julius .....Lead, S. D.
Mallman, Adolph .....Farmingdale, S. D.
Nelson, Oliver .....Rapid City, S. D.
Spencer, Floyd .....Newell, S. D.

Wilson, Sidney E. .....Deadwood, S. D.

Special Students

Bentley, Norma .....Rapid City, S. D.
Crook, Maud L'Anphere .....Rapid City, S. D.
Hood, Marion .....Rapid City, S. D.
McKirahan, Samuel.....Rapid City, S. D.
Rudesill, Rachel .....Rapid City, S. D.
Sherman, Fred W. .....Maiden, Montana
Van Nuys, Claude C. .....Rapid City, S. D.

Preparatory Students

Anderson, Avery .....Rapid City, S. D.
Bentley, James .....Rapid City, S. D.
Bergeson, Arthur .....Wall, S. D.
Bruce, Marion .....Wall, S. D.
Bump, Almyr .....Scenic, S. D.
Cordes, Ellsworth W.....Rapid City, S. D.
Cordes, Richard .....Rapid City, S. D.
Crabtree, Hampton .....Rapid City, S. D.
Crabtree, Verne .....Rapid City, S. D.
Enos, George .....Cottonwood, S. D.
Harvey, William .....Rapid City, S. D.
Hewitt, Roswell E. .....Rapid City, S. D.
Hoffman, Edgar .....Keystone, S. D.
Johnson, Edgar .....Buffalo Gap, S. D.
Johnson, Ira .....Buffalo Gap, S. D.
Karr, Harold .....Hill City, S. D.
Klar, Noel .....Rapid City, S. D.
Lintz, James .....Hermosa, S. D.
Lintz, John .....Hermosa, S. D.
Lintz, Mark .....Hermosa, S. D.
Lynch, Maurice .....Rapid City, S. D.
March, Guy .....Hill City, S. D.
March, Raymond .....Hill City, S. D.
Miller, Ben .....New Underwood, S. D.
Morrison, Edgar .....Rapid City, S. D.
Mulcahy, Edmund .....Rapid City, S. D.
O'Harra, Paul .....Rapid City, S. D.

Platt, Charles .....Caputa, S. D.
Platt, Edward .....Rapid City, S. D.
Platt, Isaac .....Caputa, S. D.
Reinbold, Hugo .....Custer, S. D.
Roberts, Worley .....Rapid City, S. D.
Sands, William .....Rapid City, S. D.
Saxer, Clarence .....Rapid City, S. D.
Schrader, Huston .....Rapid City, S. D.
Todd, Lewis .....Rapid City, S. D.
Weeks, Sanford H. .....Rapid City, S. D.

Alumni

Eighteen Hundred Eighty-Eight

John W. Hancher, B. S., M. S., South Dakota School of Mines; LL. D., Simpson College; 150 Fifth Avenue, New York, N. Y.

Eighteen Hundred Ninety

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S. Western Representative Gerhard-Mennen Chemical Co., Newark, N. J.

Eva Robinson, B. S., M. A. Professor of Home Economics, University of South Dakota, Vermillion, S. D.

Eighteen Hundred Ninety-One

Mrs. Otillie Behrens Alger, B. S., Custer, S. D.

Nineteen Hundred One

G. Howell Clevenger, B. S., E. M., South Dakota School of Mines; M. A., Columbia University; Associate Professor of Metallurgy, Stanford University, California.

Max Hopkins, B. S. With International Correspondence School of Scranton, Pa. Address, 1415 Majestic Building, Milwaukee, Wis.

Nineteen Hundred Two

Areli C. Overpeck, B. S., E. M. Rapid City, S. D.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four

Samuel S. Arentz, B. S., E. M. Mining Engineer. Dooly Building, Salt Lake City, Utah.

Arthur E. Hall, B. S., M. E. General Superintendent American Smelting and Refining Co., Omaha, Neb.

Elmer W. West, B. S., M. E. Chemist, Alliance, Nebraska.

Guy E. Wolcott, B. S. Mining Engineer, Cripple Creek, Colorado.

Nineteen Hundred Five

O. Allen Anderson, B. S., E. M. Mining Engineer, Saco, Montana.

James Halley, Jr. B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Mine Superintendent, Oliver Iron Mining Co., Buhl, Minn.

Nineteen Hundred Six

Edwin Coolidge, B. S., E. M. Leasing Spotted Horse Mine, Maiden, Mont.

Harry T. Curran, B. S., E. M. Superintendent Argo Reduction Co., Idaho Springs, Colorado.

William Gains, B. S. Mill Superintendent, Beaver Creek Mining Co., Dodson, Montana.

B. D. O'Brien, E. E. Rose Polytechnic, 1896; B. S., E. M., South Dakota School of Mines. Sundance, Wyo.

Louis L. Penhoel, B. S. Assistant Superintendent Montezuma Copper Co., Nacozari, Sonora, Mexico.

J. Burns Read, B. S., E. M. Assistant Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Herbert Seiter, B. S. Mining Engineer, Omaha, Nebr.

Earl Van L. Smith, B. S., Akron, Ohio.

Peter Whylock, B. S. Mining Engineer, Cripple Creek, Colorado.

Frederick H. Witherald, B. S., M. E., Mining Engineer, Rockland, Nevada.

Nineteen Hundred Seven

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Frank Bryant, B. S., E. M. Leasing Spotted Horse Mine, Maiden, Mont.

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Otto Ellerman, B. S., E. M. State Mine Inspector, Lead, S. D.

Bernard Matson, B. S., U. S. Assay Office, New York, N. Y.

Lloyd Mellinger, B. S. Assayer and Chemist, Eureka, Utah.

Milton Morris, B. S. Rapid City, S. D.

C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M. Columbia University. Professor of Physics, Colorado School of Mines, Golden, Colorado.

Charles Whitmore, B. S. Hardware Merchant, Canton, S. D.

Leon Peck Wells, B. S. Vice-president Aberdeen Wholesale Grocery Co., Aberdeen, S. D.

Nineteen Hundred Eight

Cyril Coolidge, B. S. Mining Engineer, Tyrone, New Mexico.

Ivan E. Goodner, B. S. Mining Engineer, Paradise, California.

L. L. Hebblethwaite, B. S., Evanston, Ill.

Glen P. Ives, B. S., E. M. General manager, Compani de Minas, Cachiral, Taltal, Chile.

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W. G. Sparling, B. S., Rapid City, S. D.

D. C. Woodard, B. S. Assayer and Metallurgist, La Serena, Chile.

Fred W. Winters, B. S., E. M. Lake City, Minn.

Nineteen Hundred Nine

Jesse O. Betterton, B. S., M. E. Chemist American Smelting and Refining Co., Omaha, Nebraska.

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Willard C. Marshall, B. S. With Rapid City Pressed Brick Co., Rapid City, S. D.

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Nineteen Hundred Ten

Richard T. Bennett, B. S. Electrian, Minneapolis, Minn.

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John Wing Elliott, B. S., Manager Columbus Auto Company, Columbus, Neb.

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Nineteen Hundred Eleven

William L. Anderson, B. S., M. E., Mining Engineer, Rochester, Nevada.

Floyd Brooks, B. S. Mining Engineer, Sudbury District, Worthington, Ontario.

Chester G. Ehle, B. S. Water Engineer, City Hall, Portland, Oregon.

Fred J. Muhmel, B. S. Scotland, S. D.

Elwin H. Quinney, B. S., M. E. Assistant State Engineer, Pierre, S. D.

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Nineteen Hundred Twelve

Samuel C. Dickey, B. S. With Oro Hondo Mining Co., Lead, S. D.

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Nineteen Hundred Thirteen

Alfred Alder, Jr., B. S. Metallurgical Chemist, Buenos Ayres, Argentina.

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Nineteen Hundred Fourteen

W. C. Bochert, B. S. Associate Professor of Mining, South Dakota School of Mines, Rapid City, South Dakota.

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Leo Fleischman, B. S. Mine Superintendent, Rowena, Colorado.

Robert S. Hill, B. S. Diamond Prospector, care Forminiere Mission, Kasai, Tshikapa, Congo Belge. Via Boma and Luebo.

Willard J. McCauley, B. S., Aberdeen, S. D.

R. O. Meents, B. S. Superintendent La Reina Mineria Campania de Mexico, Altar, Sonora, Mexico.

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Nineteen Hundred Fifteen

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Clyde E. Gates, B. S. High School Teacher, Minto, N. D.

B. Marvel O'Harra, B. S. Chemist American Smelting and Refining Co., Omaha, Neb.

Arthur Thiel, B. S. In Testing Laboratory Anaconda Copper Co., Anaconda, Montana.

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